" A CLINICAL STUDY OF SINGLE DOSE PRE-OPERATIVE ANTIBIOTICS VERSUS MULTI-DOSE AS PROPHYLAXIS IN A CASE OF UNCOMPLICATED ACUTE APPENDICITIS "

A DISSERTATION SUBMITTED TO THE TAMILNADU

Dr.MGR MEDICAL UNIVERSITY

CHENNAI

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR

THE DEGREE OF

M.S. (GENERAL SURGERY)

DEPARTMENT OF GENERAL SURGERY

TIRUNELVELI MEDICAL COLLEGE & HOSPITAL

TIRUNELVELI

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PROTOCOL TITLE: A CLINICAL STUDY OF SINGLE DOSE PREOPERATIVE ANTIBIOTICS VERSUS MULTI DOSE AS PROPHYLAXIS IN A CASE OF UNCOMPLICATED ACUTE APPENDITIS.

NAME OF PRINCIPAL INVESTIGATOR: Dr. S.Pradeep, MBBS.,
DESIGNATION OF PRINCIPAL INVESTIGATOR: Post Graduate in MS General Surgery
DEPARTMENT & INSTITUTION: Department of General Surgery, Tirunelveli Medical College

Dear Dr. Dr. S.Pradeep, *The Tirunelveli Medical College Institutional Ethics Committee (TIREC) reviewed and discussed your application during the IEC meeting held on 14.05.14.*

THE FOLLOWING DOCUMENTS WERE REVIEWED AND APPROVED

1. TIREC Application Form ☐
2. Study Protocol ☐
3. Department Research Committee Approval ☐
4. Patient Information Document and Consent Form in English and Vernacular Language ☐
5. Investigator's Brochure ☐
6. Proposed Methods for Patient Accrual Proposed ☐
7. Curriculum Vitae of the Principal Investigator ☐
8. Insurance /Compensation Policy ☐
9. Investigator's Agreement with Sponsor ☐
10. Investigator's Undertaking ☐
11. DCGI/DGFT approval ☐
12. Clinical Trial Agreement (CTA) ☐
13. Memorandum of Understanding (MOU)/Material Transfer Agreement (MTA) ☐
14. Clinical Trials Registry-India (CTRI) Registration ☐

THE PROTOCOL IS APPROVED IN ITS PRESENTED FORM ON THE FOLLOWING CONDITIONS

1. The approval is valid for a period of 2 year/s or duration of project whichever is later
2. The date of commencement of study should be informed
3. A written request should be submitted 3weeks before for renewal / extension of the validity
4. An annual status report should be submitted.
5. The TIREC will monitor the study
6. At the time of PI's retirement/leaving the institute, the study responsibility should be transferred to a person cleared by HOD
7. The PI should report to TIREC within 7 days of the occurrence of the SAE. If the SAE is Death, the Bioethics Cell should receive the SAE reporting form within 24 hours of the occurrence.
8. In the events of any protocol amendments, TIREC must be informed and the amendments should be highlighted in clear terms as follows:
    a. The exact alteration/amendment should be specified and indicated where the amendment occurred in the original project. (Page no. Clause no. etc.)
    b. The PI must comment how proposed amendment will affect the ongoing trial. Alteration in the budgetary status, staff requirement should be clearly indicated and the revised budget form should be submitted.
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    g. Any deviation/violation/waiver in the protocol must be informed

STANDS APPROVED UNDER SEAL

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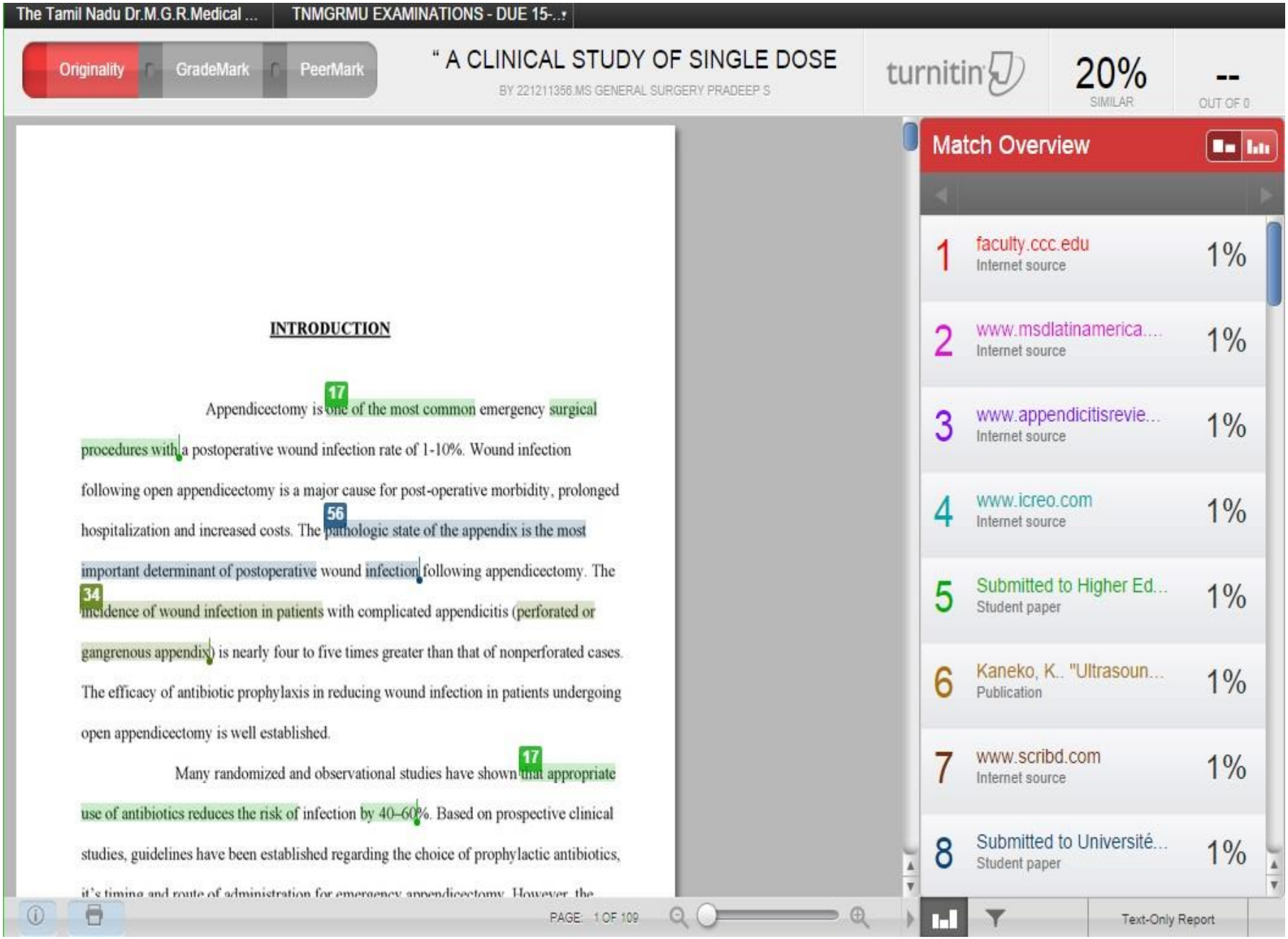
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INTRODUCTION
Appendicectomy is one of the most common emergency surgical procedures with a postoperative wound infection rate of 1-10%. Wound infection following open appendicectomy is a major cause for post-operative morbidity, prolonged hospitalization and increased costs. The pathologic state of the appendix is the most important determinant of postoperative wound infection following appendicectomy. The incidence of wound infection in patients with complicated appendicitis (perforated or gangrenous appendix) is nearly four to five times greater than that of nonperforated cases. The efficacy of antibiotic prophylaxis in reducing wound infection in patients undergoing open appendicectomy is well established.
Many randomized and observational studies have shown that appropriate use of antibiotics reduces the risk of infection by 40–60%. Based on prospective clinical studies, guidelines have been established regarding the choice of prophylactic antibiotics,
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ABSTRACT

BACKGROUND:

The most common and significant cause for morbidity following emergency appendicectomy is surgical wound infection. There are conflicting reports regarding the optimal duration of antibiotic prophylaxis in uncomplicated acute appendicitis. The efficacy of prolonged prophylactic antibiotic treatment in preventing wound infection for uncomplicated acute appendicitis is poorly defined.

OBJECTIVES:

A prospective randomized study was carried out to compare the efficacy of single dose pre-operative antibiotics with multiple antibiotic doses in reducing the incidence of postoperative wound infection for patients with uncomplicated acute appendicitis.

METHODS:

One hundred patients with a diagnosis of uncomplicated acute appendicitis were randomized into two groups. Group 1 received single intravenous dose of 1gm cefotaxime & metronidazole 500mg ½ hour before surgery and group 2 received multiple doses following surgery. Postoperative wound infection was the primary endpoint.

RESULTS:

The two groups were similar with regard to all aspects. The postoperative wound infection rate was not significantly different among the two groups, 8% in group 1 and 7% group 2 (p =0.959).

CONCLUSION:

Single-dose pre-operative antibiotics is equally effective to multiple-dose in preventing postoperative wound infection in patients undergoing open appendicectomy for uncomplicated acute appendicitis. However, because of the greater convenience and economic implications, single-dose pre-operative antibiotics is the choice of prophylaxis for uncomplicated acute appendicitis.

KEYWORDS:

acute appendicitis, antibiotics, single dose, uncomplicated

INTRODUCTION

Appendicectomy is one of the most common emergency surgical procedures with a postoperative wound infection rate of 1-10%. Wound infection following open appendicectomy is a major cause for post-operative morbidity, prolonged hospitalization and increased costs. The pathologic state of the appendix is the most important determinant of postoperative wound infection following appendicectomy. The incidence of wound infection in patients with complicated appendicitis (perforated or gangrenous appendix) is nearly four to five times greater than that of nonperforated cases. The efficacy of antibiotic prophylaxis in reducing wound infection in patients undergoing open appendicectomy is well established.

Many randomized and observational studies have shown that appropriate use of antibiotics reduces the risk of infection by 40–60%. Based on prospective clinical studies, guidelines have been established regarding the choice of prophylactic antibiotics, it's timing and route of administration for emergency appendicectomy. However, the duration of antibiotic usage remains a contentious issue and there is no definite consensus among the surgical community.

Single dose antibiotic prophylaxis has been recommended for majority of elective general surgical procedures. In reality, this practice is not universally accepted and multiple dose regimens are still in use at many centres.

In the emergency setting, though postoperative antibiotics are universally used for perforated appendicitis, no consensus exists regarding the efficacy of postoperative antibiotics in preventing surgical site infections in non-perforated cases. The main purpose of our study was to compare the efficacy of single dose pre-operative antibiotics with multi dose in reducing the incidence of post operative wound infection in patients with uncomplicated acute appendicitis.

AIMS AND OBJECTIVES OF THE STUDY

To compare the efficacy of **single dose pre-operative antibiotics** with multiple dose in reducing the incidence of postoperative wound infection in patients with **uncomplicated acute appendicitis**.

REVIEW OF LITERATURE

DEVELOPMENT:

In the sixth week, a small diverticulum appears on the caudal limb of the midgut loop and this later differentiates into the caecum and vermiform appendix.
The appendix is the terminal portion of the embryonic caecum. The appendix becomes distinguishable by its failure to enlarge as fast as the proximal caecum. This difference in growth rate continues into postnatal life. At birth, the diameter of the colon is 4.5 times that of the appendix & at maturity, it is 8.5 times larger.

The appendix is visible at about the eighth week of gestation. At first, it projects from the apex of the caecum. As the caecum grows, the origin of the appendix shifts medially towards the ileo-caecal valve . The taeniae of the longitudinal muscle coat of the colon originate from the base of the appendix, showing the same displacement .

ANATOMY:

Vermiform Appendix is a narrow, worm shaped tube, which springs from the posterio-medial wall of the caecum, 2 cm or less below the end of the ileum. The length of the appendix varies from 2-20 cms average being 9 cms. It is longer in children than in adults and may atrophy after mid adult life. Its position may vary, and named according to the position .

POSITIONS:

1. RETROCAECAL / RETROCOLIC - 74%

2. PELVIC - 21%

3. SUB - CAECAL - 1.5%

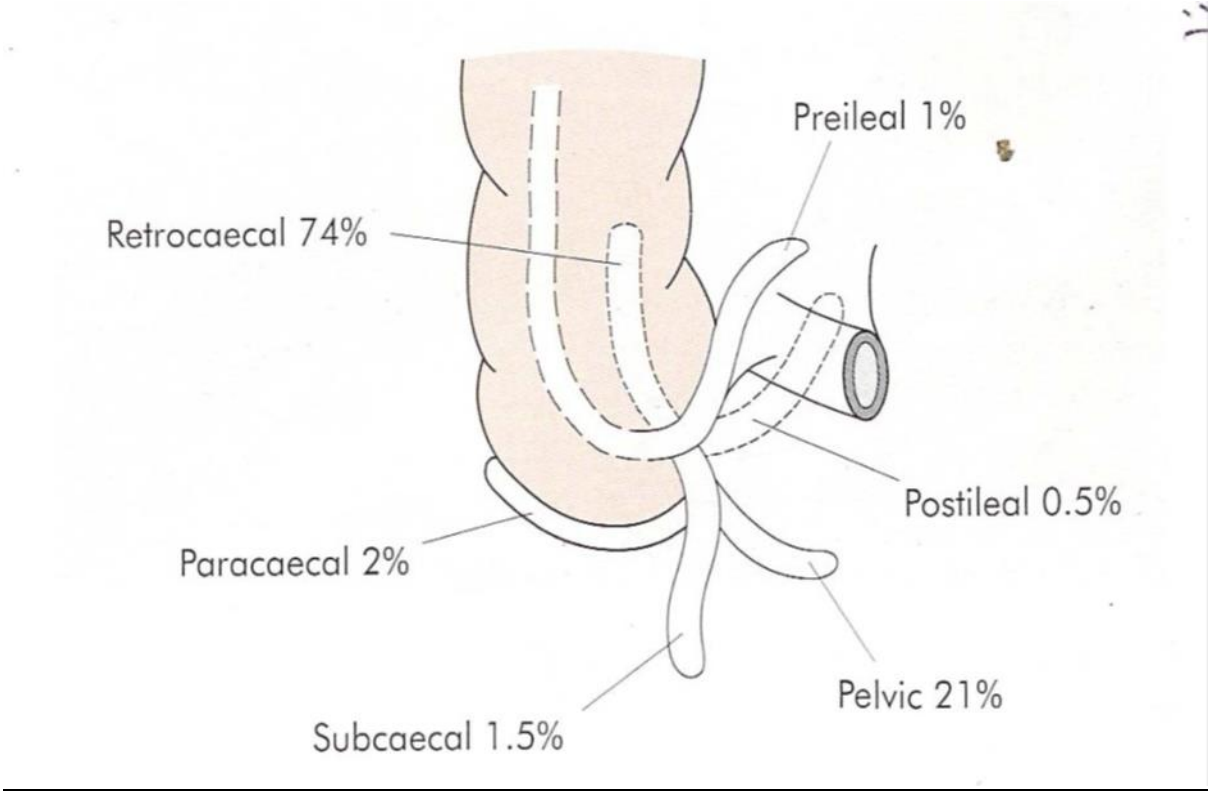
4. PRE- ILEAL - 1.0%

5. POST-ILEAL - 0.5%

6. PARACAECAL - 2.0

7. SUB-HEPATIC (rare)

POSITIONS OF APPENDIX



Although it has often been suggested, no consistent correlation between position of appendix and frequency of appendicitis has been confirmed. In a retrospective review of operative reports and in an analysis of 94 appendicectomies, Shen and colleagues found that the retrocaecal position of the appendix did not alter the clinical course of appendicitis.

The surface marking most often used for the base of the appendix is the junction of the lateral one third and medial two thirds of the line joining the Right Anterior Superior Iliac Spine to the umbilicus, popularly known as Mc Burney's point.

The three taenia coli on the ascending colon and caecum converge on the base of the appendix, where they merge into its longitudinal muscular layer. The anterior taenia (taeniae libra) of the caecum is generally distinct and can be easily traced to the root of the appendix, used as a guide.

APPENDICEAL WALL:

The appendiceal wall is similar to the wall of the colon. It is formed by

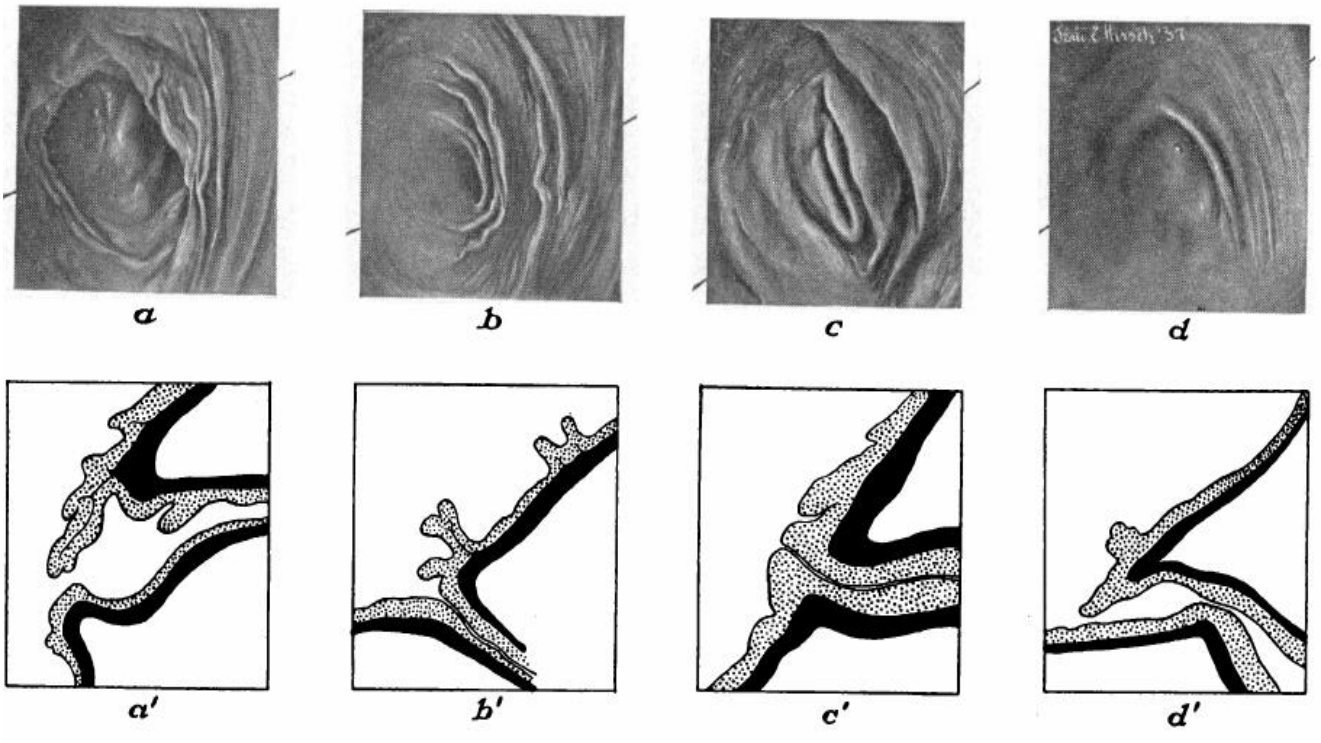
1) SEROSA
2) MUSCULAR LAYER: A muscular layer composed of the longitudinal and circular layers. At the appendiceal base, the longitudinal muscle produces a thickening that is related to all caecal taeniae.
3) SUBMUCOSA: It contains many lymphoid islands.

4) MUCOSA: The lumen of the appendix is small, and opens into caecum by an orifice lying below and little behind the ileo-caecal opening. This orifice is guarded by a semi - lunar mucosal fold.

PERITONEAL FOLDS AND RECESSES AROUND CAECUM AND APPENDIX:

- Superior ileo-caecal recess.
- Inferior ileo-caecal recess.
- Retro-caecal recess

APPENDICEAL ORIFICES



APPENDICEAL ORIFICES & MUCOSAL FOLDS AND THE CUT SECTIONS THROUGH THE AXIS OF APPENDIX

(a) very large round orifice with prominent Gerlach's fold.

(b) small crescent shaped orifice with Gerlach's fold and secondary mucosal fold overlying the appendiceal opening.

(c) slit like appendiceal orifice with Gerlach's fold and one large secondary mucosal fold.

(d) Pinpoint orifice with persistent mucosal fold with Gerlach's fold overlying.

MESENTRY OF APPENDIX:

The mesentery of the appendix is embryologically derived from the posterior side of the mesentery of the terminal ileum. The mesentery attaches to the caecum as well as to the proximal appendix. It contains the appendicular artery.

FUNCTIONS OF APPENDIX:

The human vermiform appendix is usually referred to as a vestigial organ with no known function. This implies a more fully developed organ in an earlier stage of the individual or in earlier stages of the evolution of the species. On the contrary, currently available evidence suggests that the appendix is a highly specialized part of the alimentary tract.

The appendix participates in the secretory immune system in the gut (IgA). Secretory immunoglobulins produced by the gut-associated lymphoid tissue (GALT) function as a very effective barrier that protects the milieu interior against the hostile milieu exterior.

Though the appendix is an integral part of the GALT- mediated secretory globulin immune mechanism, it is not indispensable. Removal of the appendix produces no detectable defect in the functioning of the immunoglobulin system. Thus, the human appendix is a useful, though not indispensable immunologic organ.

Wangenstein et al (1939) have observed that the caecal appendage of the rabbit and the vermiform appendix of man exhibit a greater capacity for secretion than for absorption of fluids. In this function lies the explanation as to why the appendix is a treacherous organ when obstructed .

VASCULAR SUPPLY:

The mesoappendix contains main appendicular artery which is a branch of lower division of the ileo-colic artery. Appendicular artery enters the mesoappendix a short distance from the base of the appendix with a branch of the posterior caecal artery. The main appendicular artery approaches the tip of the organ at first near to and then on the edge of the mesoappendix. However, the terminal part of the artery lies on the wall of the appendix and hence may be thrombosed in appendicitis, resulting in distal gangrene or necrosis. The arterial supply of appendix may vary considerably. Accessory arteries are common; in 80% of subjects, there were two or more accessory artery. This is known as Dr. Sheshachalam artery. This has got applied importance during appendicectomy.

LYMPHATIC DRAINAGE:

Lymphatic drainage from the ileocaecal region is through a chain of nodes on the appendicular, ileocolic, and superior mesenteric arteries through which the lymph passes to reach the celiac lymph nodes and the cisterna chyli. Lymph nodules in the wall of the appendix are not connected with the lymphatic drainage of the organ. The lymphocytes formed in the nodules pass into the lumen of the appendix.

INNERVATION:

Sympathetic innervation of the appendix originates from the celiac and superior mesenteric ganglia. Parasympathetic innervation originates from the vagus nerve.

Sensory innervation for pain is carried by the eighth thoracic spinal nerve, or perhaps by the 10th and 11th thoracic nerves.

ANATOMICAL CONSIDERATIONS CONTRIBUTING TO APPENDICITIS:

- It is a long tube with narrow lumen.
- It is a cul-de-sac (one end is blind).
- It is rich in lymphoid tissue (Known as Abdominal Tonsil).
- It has position variations like retro caecal - Kink at the base, etc.,
- It has got a false valve of Geralach.(At the junction of the caecal appendicular opening).
- Appendicular artery is an end artery near to the caecum which is rich with all organisms.

CONGENITAL ABNORMALITIES

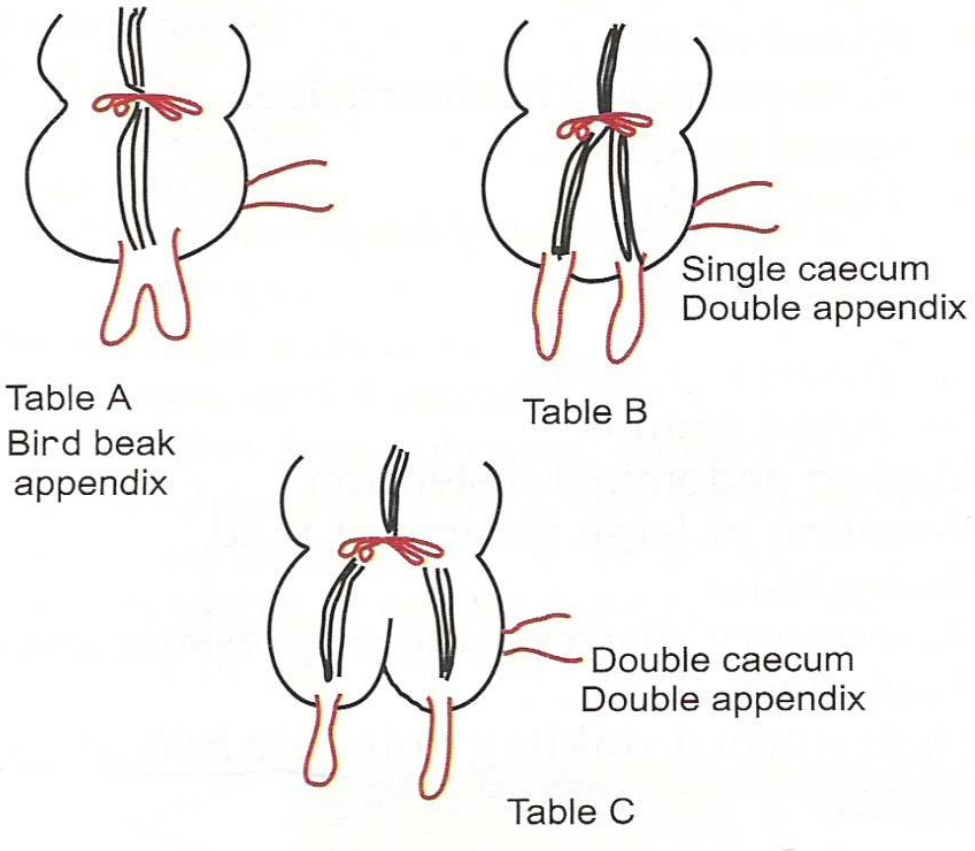
AGENESIS:

Once in 1,00,000 persons the appendix is absent. Collins collected 57 cases of true agenesis of appendix.

DUPLICATION:

A few cases of double appendix have been reported, in some instances one of the twin appendices has been found acutely inflamed and other was not involved.

DUPLICATION OF APPENDIX (WALL BRIDGE CLASSIFICATION)



Duplication of appendix was classified by wall bridge as follows:

Type A:- Partial duplication in a single caecum.

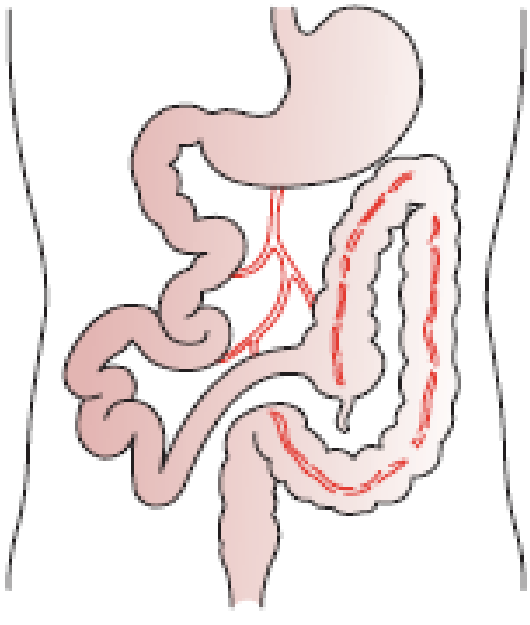
Type B:- Two separate appendices in a single caecum.

Type C:- Double caecum with each one having one appendix.

LEFT SIDED APPENDIX:

Situs inversus viscerum, a congenital abnormality where there is complete transposition of thoracic and abdominal viscera, occurs once in 35,000 individuals and is more common in males. In such cases of course the vermiform appendix in situated on left side as it is also in some cases of non-rotation of midgut.

LEFT SIDED APPENDIX



HIGH CAECUM:

Failure of caecum to descend, results in appendix situated in Rt Hypochondrium. Occasionally caecum and appendix are situated in Lt Hypochondrium or LIF.

ECTOPIC APPENDIX:

Fawcitt found an appendix in the thorax, in association with malrotation and diaphragmatic defect. Babcock reported the removal of an appendix in the lumbar area. Abramson presented a case of an appendix which was located within the posterior caecal wall, and which did not have a serous coat.

HETEROTOPIC MUCOSA IN APPENDIX:

Gastric mucosa, pancreatic tissue, and esophageal mucosa have been reported in the appendix. Haque et al. found heterotopic bone associated with mucin-producing tumors of the appendix.

CONGENITAL APPENDICEAL DIVERTICULAE:

Although the appendix is subject to diverticulum formation like the rest of the intestine, there have been few reports of the formation of true congenital appendiceal diverticula. Favara found an association between genetic abnormalities and congenital diverticula.

HISTORY:

The appendix was probably first noted as early as the Egyptian civilization(3000 BC). During the mummification process, abdominal parts were removed and placed in Coptic jars with inscriptions describing the contents. When these jars were uncovered, inscriptions referring to the "worm of the intestine" were discovered. The appendix is kindly represented attached to the bowel in Greek votive jars from Cos and Gnidos, but Aristotle and Galen were ignorant of this structure as their anatomical dissertation studies were confined to the lower mammalian orders. Tiberius Ceasas permitted celsus to dissect on the executed criminals and he must have felt the presence of appendix.

Areteaus of cappadocia in 30 A.D described the case of a patriot who recovered from either an appendiceal or a perinephric abscess after simple drainage through abdominal wall.

Berengas Da Corpi (1524) gave the first full account of the appendix and appendicular perforation.

Andreas Vesalius (1543) Professor of Anatomy at Ponda, has given a detailed description of the normal appendix in his treatise on ‘Defabrica Alumani Corporis.

In 1706, morgagni in his ‘Adversavia Anatonica’ has devoted some portion of his work to the appendix, to describe, its normal size, site and its relation to other structures. It was known to vesalius as ‘caecum’ meaning thereby ‘a blind pouch’ in Latin.

In 1710, ‘Verhgen’coined the name Appendix.

In 1742, santorini stated that the appendix served as a rest for worms in gastrointestinal tract.

Liberkuhn in 1739, published a classic paper on appendix in which he first time described the crypts in the mucosa, which as we all know bears his name.

Weibrient (1739) described the valve situated at the junction of the appendix and caecum.

In 1735, on Dec. 6th, Claudius Amyand performed first appendicectomy. He operated on a boy Hanvil Anderson aged 11 years at St. George's Hospital, London who was suffering from an inguinal hernia and faecal fistula discharging in the groin. During operation, the appendix was found in the hernial sac and the fistula was traced to a perforation of the appendix by a pin. Amyand excised the appendix in an operation which lasted almost half an hour. Boy recovered, case was reported in the philosophical transactions of the royal society in 1736.

In 1755, Heister recognized that the appendix might be the site of acute primary inflammation. He vividly describes an autopsy or the body of a criminal who had been executed and found blackish appendix which discharged 2–3 spoonful of pus during its manipulation.

In 1824, Wyes killer gave a presentation to the Royal Academy of Medicine in Paris entitled observations in the inflammatory conditions of caecal appendix. In which he describes two examples of acute appendicitis leading to mortality.

In both cases at autopsy, the appendix was found to be black and gangrenous while the caecum was scarcely involved.

In 1839, the first text book to give a description of the symptoms and signs that accompanies inflammation and perforation of the appendix was published by Bright and Addison.

In 1886 Reginald Fitz, Professor of Medicine at Harvard, who gave lucid and logical description of the clinical features and described in details the pathological changes of the disease. He was the first to use the term 'Appendicitis'. Fitz suggested that appendicectomy would be essential to cure.

In 1889, **Mc Burney** in New York described the early diagnosis and early operative intervention and also devised the muscle splitting incision (Grid - Iron) named after him. Early intervention was still further popularized by the teaching of Murphy at Chicago. Both these surgeons pioneered the removal of the appendix before perforation had been allowed to take place.

In 1910, **Alberg Ochsner** at Chicago, and **James Sherren** at Londan, were both advocates of conservative treatment in late cases. This was popularized as **Ochsner - Sherren regimen** because of the higher mortality rate of operations for perforated cases with peritonitis. But new advent of antibiotics resolved the controversy between the schools of conservative and active surgery in such cases.

In 1912, Moynihan profounded that most of the peptic ulcers originated from a previously diseased appendix (Appendinator gastrolgia).

Even in the modern era, inspite of the many fascinating investigations that have entered the field to assist the surgeon in the diagnosis of appendicitis like Ultrasonography of abdomen, C.T.Scan of abdomen, Isotope scanning, C-reactive 15 protein etc. But still nothing has proved superiority over the simple repeated clinical examination & Alvarado scoring systems.

Big tussle is going on between traditional appendicectomy (open appendicectomy) and Laparoscopic appendicectomy, as which is better in the given situation. Today, Laparoscopic appendicectomy procedure is slowly overtaking the traditional appendicectomy, because of its obvious advantages.

INCIDENCE:

Appendicitis is more common in males.The male:female ratio is 1.4:1.Life time risk of appendicitis is 8.6% & 6.7% in males & females respectively. 70% of appendicitis is seen in <30 years of age. In males, the incidence is more common in **10 – 14** years of age. In females, the incidence is more common in **15 – 19** years of age.

GEOGRAPHIC DISTRIBUTION:

The recent trend is fall in the incidence of true appendicitis and it appears to be continuing. The decline has been noted in many countries particularly USA, UK,Wales and Scandinavia. Some of the decrease in number of primary Appendicectomies is attributable to better diagnosis. But the declining incidence is much greater that can be accounted of by better diagnosis alone. No definite reason for the declining incidence of appendicitis has been explained. Speculations are changing dietary habits, changing intestinal flora, higher vitamin intake, antibiotics and many other reasons. The mortality rate has decreased drastically in Europe and USA from 8% per 1, 00,000 of their population in 1941 to less than 1 per 1, 00,000 in 1970. Early diagnosis, immediate intervention and administration of proper antibiotics share the credit of this. The absolute incidence of the disease also decreased by about 40% between 1940 and 1960.

CLASSIFICATION OF APPENDICITS:

1. Acute appendicitis
2. Recurrent appendicitis - Recurrent acute appendicitis,Recurrent sub-acute appendicitis
3. Chronic appendicitis
4. Other causes - Crohn's, tuberculus appendicitis, ulcerative colitis, actinomycotic infections, yersinia infections, carcinoma caecum etc.,

CLASSIFICATION OF ACUTE APPENDICITIS:

Depending on the gross and microscopic picture of the inflamed appendix

1. **Acute focal appendicitis (Catarrhal):**

The appendix is grossly normal, but microscopic sections studied shows scattered foci of inflammatory infiltrate within the wall, mucosal ulcers may be present.

2. **Acute suppurative appendicitis:**

The appendix is grossly inflammed, edematous and injected with peritoneal exudates. Microscopic sections show diffuse inflammation.

3. **Acute gangrenous appendicitis:**

Vascular thrombosis is present in addition to signs of inflammation but no gross perforation.

4. **Acute appendicitis with perforation:**

There is severe inflammation of the appendix with disruption of the wall and exit of appendiceal contents into peritoneal cavity.

5. **Acute appendicitis with peri-appendiceal abscess:**

This is secondary to perforation with an attempt to localization of the inflammatory process by adjacent structures.

ETIOLOGY:

RACE AND DIET:

Appendicitis is particularly common in highly civilized European, American and Australian Countries, while it is rare in Asians, Africans, and Indonesians. Rendle short showed that, if individuals from later races migrate to countries where appendicitis is common, they soon acquire the local susceptibility to the disease. Even in apes in capacity appear to acquire the human liability to appendicitis. These significant facts satisfy many, that raise of appendicitis among the highly civilized is due to departure from a simple diet rich in cellulose to one relatively rich in meat. But this cannot be the whole explanation for acute appendicitis occurs in life long vegetarians and even in babies at breast.

SOCIAL STATUS:

Acute appendicitis in more common among the upper and middle classes than those belonging to the working class.

FAMILIAL SUSCEPTIBILITY:

This is unusual but generally well accepted fact can be accounted for by an inherited malformation or malposition of the organ, which predisposes to infection and similar diet consumption among all the members of the given family.

TRAUMA:

Few cases of traumatic appendicitis has been reported. And some have even advocated guidelines for diagnosing primary traumatic acute appendicitis. It is very difficult to say whether the attack of appendicitis was primary or precipitated by trauma. Trauma may be just a coincidence.

BACTERIAL FACTORS:

Aerobic and Facultative	Anaerobic
Gram-negative bacilli	Gram-negative bacilli
Escherichia coli	*Bacteroides fragilis*
Pseudomonas aeruginosa	Other *Bacteroides* species
Klebsiella species	*Fusobacterium* species
Gram-positive cocci	Gram-positive cocci
Streptococcus anginosus	*Peptostreptococcus* species
Other *Streptococcus* species	Gram-positive bacilli
Enterococcus species	*Clostridium* species

VIRAL FACTORS:

The association of systemic viral infections like measles and appendicitis is known. The cause of appendicitis in such situation is probably secondary to obstruction of the lumen of appendix by hyperplastic lymphatic follicles. However, recent studies have speculated that viral infection as the possible cause of mucosal ulceration, a primary event in the majority of cases of appendicitis.

NEUROHORMONES RELEASED BY APPENDIX:

Sometime the neuropeptides released from the appendix may be responsible for appendiceal pain.

OBSTRUCTION:

Wilkie (1914), wangensteen et al. (1937 and 1940) and Pieper et al (1983) have documented appendicitis following obstruction of appendix in experimental animals.Wangensteen et al showed that combined obstruction and bacterial infection resulted in acute appendicitis, where as obstruction of a bacteria free lumen of appendix resulted in a mucocoele.

The obstruction may be due to a large number of possible causes:

1. **IN THE LUMEN:** Faecolith, Parasites (Pin worm, Ascaris lumbricoides, taenia), Foreign body (rare cause), vegetables & fruit seeds, inspissated barium, pins, lead shot, bones, egg shells, glass, teeth, nails, die (dice), the clinical end of thermometer etc.,

2. **IN THE WALL:** Lymphoid hyperplasia, stricture, tumors - carcinoid of appendix, appendicular metastasis especially from breast carcinoma.

3. **OUT SIDE THE WALL:** Adhesions and Kinks - congenital and postinflammatory, strangulation in a hernial sac.

4. CARCINOMA OF THE CAECUM AND ASCENDING COLON

FAECOLITH:

Faecal material is commonly present in both the normal and the inflammed appendix and this should be differentiated from the true Faecolith, which is ovoid, about 1-2 cms in length, and faecal coloured. Unlike ordinary faeces, the true Faecolith shows a well ordered lamination in section.

Composition: Inspissated faecal material, calcium & magnesium phosphates ,carbonates, epithelial debris, bacteria & rarely a foreign body is seen in the faecolith.

Significance: Related to Appendicular stasis.

Radio – opacity:

In 10% of acute appendicitis contains sufficient calcium in Faecolith to be demonstrated on plain radiograph of abdomen. X-ray examination of specimen of appendix demonstrated radio-opaque faecoliths in 33% of cases. Radiological demonstration of a stone is an absolute indication for appendicectomy irrespective of signs and symptoms.

LYMPHATIC HYPER PLASIA:

The amount of lymphatic tissue in appendix parallels the incidence of acute appendicitis. Hyperplastic follicles may partially obstruct the lumen setting the stage for development of appendicitis. Hyperplasia of lymphoid tissue may be a response to an acute respiratory infection, measles, infectious mononucleosis,etc. The follicles of appendix also respond to infection in the gut- Salmonella and Shigella enterocolitis.

PARASITES:

Pin worms and Ascaris are the commonest parasites reported to cause luminal obstruction.

STRICTURE:

Fibrosis of wall from previous attacks of inflammation can contribute by narrowing the lumen and promoting Faecolith impaction.

OBSTRUCTED APPENDIX

CARCINOMA OF CAECUM PRESENTING AS ACUTE APPENDICITIS OR ABSCESS:

Malignant growth in the caecum can cause appendicitis by obstruction of the lumen of appendix or its blood vessels or lymph vessels. When appendicitis and carcinoma of caecum co-exist, symptomatology of appendicitis dominates the picture.

STRANGULATION WITHIN A HERNIAL SAC:

It is perhaps the rarest cause of obstructive appendicitis. Thomas et al. (1982) reported seven such cases. The most common hernia to be involved is the right femoral, the right inguinal, but cases have been reported of acute appendicitis within left inguinal, an umbilical, an incisional and the correct diagnosis virtually has never made before operation.

PATHOGENESIS:

The primary pathogenic event in acute appendicitis was thought to be intra-luminal obstruction because of the following observations:

1) The frequency with which a Faecolith can be demonstrated blocking the lumen in a case of acute appendicitis.

2) Even in the absence of Faecolith, the inflammatory changes stops short at the base of the appendix, or more distally with a clear line of demarcation, once again suggesting obstruction.

3) The distal portion beyond obstruction may be inflammed alone, but the proximal to obstruction is never inflammed.

4) Inflammatory changes are generalized throughout the mucosa of the affected portion and never localized, as might be expected if infection of the mucosa were the initial lesion.

5) The early epigastric or peri-umbilical colic suggests muscular spasm rather than an initial inflammatory lesion.

A recent study showed that obstruction is not an important factor in the causation of acute appendicitis, but may develop as a result of the inflammatory process. Recent studies also show that ulceration in the mucosa is the initial event in the majority. The causation of this ulceration is unknown, although a viral etiology has been postulated. Whether the inflammatory reaction attendant with ulceration is sufficient to obstruct the tiny appendiceal lumen even transiently is also not clear.

PATHOLOGY:

At the earliest stages, only a scant neutrophilic exudate may be found throughout the mucosa, submucosa, and muscularis propria. Subserosal vessels are congested, and often there is a modest perivascular neutrophilic infiltrate. The inflammatory reaction transforms the normal glistening serosa into a dull, granular, red membrane; this transformation signifies **early acute appendicitis** for the operating surgeon.

At a later stage, a prominent neutrophilic exudate generates a fibrinopurulent reaction over the serosa. As the inflammatory process worsens, there is abscess formation within the wall, along with ulcerations and foci of suppurative necrosis in the mucosa. This state constitutes **acute suppurative appendicitis**.

Further appendiceal compromise leads to large areas of hemorrhagic green ulceration of the mucosa and green-black gangrenous necrosis through the wall, extending to the serosa, creating **acute gangrenous appendicitis,** which is quickly followed by rupture and suppurative peritonitis.

The histologic criterion for the diagnosis of acute appendicitis is neutrophilic infiltration of the muscularis propria. Usually, neutrophils and ulcerations are also present within the mucosa. Since drainage of an exudate into the appendix from alimentary tract infection may also induce a mucosal neutrophilic infiltrate, evidence of muscular wall inflammation is requisite for the diagnosis.

True chronic inflammation of the appendix is rare. Much more frequently, recurrent acute attacks may be inappropriately referred to as chronic appendicitis. In some patients the appendix from birth is a mere fibrous cord. It must not be assumed, therefore, that extensive fibrosis of the appendiceal architecture implies a chronic inflammatory reaction or the end stage of a previous inflammation.

CLINICAL DIAGNOSIS:

Acute appendicitis has various manifestations. It may simulate almost any other acute abdominal illness and in turn may be mimicked by a variety of conditions. Progression of symptoms and signs is the rule, in contrast to the fluctuating course of some other diseases. Appendicitis needs to be considered in the differential diagnosis of nearly every patient with acute abdominal pain. Early diagnosis remains the most important clinical goal in patients with suspected appendicitis and can be made primarily on the basis of the history and physical examination in most cases. Recently algorithms and symptoms ranking system (like improved clinical examination) have been reported. But these aids have not really improved the overall accuracy of pre-operative diagnosis. These have to stand the test of time and prove their superiority, even if they prove better.

The typical presentation begins with periumbilical pain (due to activation of visceral afferent neurons) followed by anorexia and nausea. The pain then localizes to the right lower quadrant as the inflammatory process progresses to involve the parietal peritoneum overlying the appendix. This classic pattern of migratory pain is the most reliable symptom of acute appendicitis. A bout of vomiting may occur, in contrast to the repeated bouts of vomiting that typically accompany viral gastroenteritis or small bowel obstruction. Fever ensues, followed by the development of leukocytosis.This is known as Murphy's triad. Pain is present in all cases with appendicitis except those with transverse myelitis or similar disability. If nausea and vomiting precede the pain, patients are likely to have another cause for their abdominal pain, such as gastroenteritis.

Surgeons have long opposed the early use of opioid analgesics in patients with abdominal pain, fearing that these agents will mask the physical signs of a surgical abdomen and lead to delayed or missed diagnosis. The impact of parentral opioid analgesics on sonographic and clinical diagnostic accuracy for suspected acute appendicitis suggests that opioid analgesia does not increase the risk of delayed or missed diagnosis of appendicitis and does not influence the rate of unnecessary laparotomy.

CLASSICAL PAIN:

Initially pain is diffusely centered in the lower epigastrium or umbilical area and later localizes to right lower quadrant and remains there.

VISCERAL PAIN:

Visceral pain is steady pain, sometimes superimposed with intermittent cramping and usually lasts for 4-6 hours (ranges from 1-12). It is mild to moderately severe and may not be noted by some patients during sleep. This visceral pain is felt around the umbilicus, in the epigastrium, or it may be generalized. It is due to distension of appendix, irritation of visceral peritoneum and hence felt like vague pain.

SOMATIC PAIN:

After a few hours this pain shifts to the point where the inflamed appendix irritates the parietal peritoneum, which is very sensitive. This pain is steady & very severe, aggravated by cough,valsalva maneuver,motion and usually located in the RLQ.

This classic pain sequence in a case of appendicitis is found in 55% of patients, but also may occur in one-fourth of patients with other intra-abdominal conditions.

ATYPICAL PAIN:

Atypical pain is defined as a pain that fails to follows the classic visceral, somatic sequence is common in acute appendicitis, occurring in 45% of patients, who prove to have appendicitis and 75% of patients in whom appendicitis initially is suspected but who prove to have some other disease.

ANOREXIA:

Anorexia commonly seen in most of the patients.If the patient is not anorectic, the diagnosis should be questioned.

FEVER:

Low-grade fever up to 101°F (38.3°C) may be seen. Higher temperatures with chills may suggest other diagnoses, including appendiceal perforation or non appendiceal sources.

NAUSEA:

At least of some degree is present in nine out of ten patients with appendicitis.

VOMITING:

CHANGE IN BOWEL HABIT

URINARY SYMPTOMS:

Urinary frequency and dysuria may be present.

PHYSICAL EXAMINATION:

APPEARANCE:

The patient is usually flushed and in obvious pain.

POSTURE:

Motion increases pain. So patients lie supine with the right thigh drawn up. If asked to move, they move slowly and gingerly. It indicates the irritation of parietal peritoneum.

TONGUE:

It becomes progressively coated and the breaths turn foul but no absolute findings are seen in tongue.

VITAL SIGNS:

Vital signs are not changed very much by uncomplicated appendicitis. Changes in vital signs usually mean that a complication has occurred, or the diagnosis is different.

TEMPERATURE:

Temperature above 38°C is unusual in uncomplicated appendicitis. Temperature above 101°F should always suggest the presence of perforation and peritonitis.

A normal temperature is present even with advanced appendicitis; higher temperature can be expected in children. Very high pyrexia suggests some other diagnosis like pyelitis or respiratory tract infection.

PULSE RATE:

Pulse rate is normal or slightly elevated in simple acute appendicitis. Tachycardia will be seen in complicated appendicitis.

BLOOD PRESSURE:

It will be usually normal in case of acute appendicitis and altered (Hypotensive) in case of sepsis.

ON INSPECTION:

Localized limitation or restriction of movement of abdomen with respiration in RIF occurs in localized irritation of the peritoneum from inflamed appendix.

ON PALPATION:

TENDERNESS IN RIF (Mc BURNEY'S POINT) (Rebound Tenderness / Blumberg's Sign / Release Sign):

"There cannot be acute appendicitis without tenderness". This tenderness may be mild and diffuse in early stage of the disease, but ultimately localizes and location will be corresponding to the position of appendix.

Abdominal tenderness may be completely absent if a retro-caecal or pelvic appendix is present, in which case the sole physical finding may be tenderness in the flank or on rectal or pelvic examination. Percussion tenderness, rebound tenderness is often, but not invariably present.

MUSCLE GUARDING AND RIGIDITY:

Muscle guarding and rigidity roughly suggests the severity of the inflammatory process. Cutaneous hyperesthesia is seen in the areas supplied by the spinal nerves T10, T11 & T12 on the right, is a frequent but not a constant accompanient of acute appendicitis.

ROVSIGN'S SIGN :

Pain in the RIF, when pressure is exerted in the LIF, is a manifestation of referred rebound tenderness. It also indicates the site of peritoneal irritation.

COPES PSOAS TEST:

Patient is asked to lie on left side & the examiner extends the right thigh slowly.If extension produces pain,the test is positive.It is due to stretching of ilio - Psoas muscle. This indicates localized Psoas muscle irritation by the inflamed appendix.

OBTURATOR TEST: This test is performed with the supine patient, by passive internal rotation of the flexed right thigh. If this maneuver causes hypogastric or adductor pain, it is said to be positive and indicates inflamed appendix lying against obturator internus muscle. It is less often positive than Psoas sign.

BALDWIGN'S TEST:

It is another test to detect retro-caecal appendicitis. While maintaining the finger tip pressure over the flank, the patient is asked to raise the right lower limb from the bed & keeping the knee extended. The test is positive, if the patient complains of pain or drops the limb with expression of agony on the face.

McBURNEY'S SIGN:

Finger tip pressure is made over the McBurney's point, patient complains of pain if there is appendicitis. This sign is useful in very early or sub-acute appendicitis.

POINTING SIGN:

Patient shows the more pain in RIF, over the McBurney's point with his finger tip in case of acute appendicitis.

SHIFTING TENDERNESS: (Alder's sign of shifting tenderness)

This sign is useful in diagnosis of appendicitis in pregnant women. Locate the tenderness spot, mark it on the skin. Then request the patient to turn on to the left side and wait for a full minute. If the tenderness of uterine origin like concealed, accidental haemorrhage, necrosis of a uterine fibroid, it will shift with the uterus. Whereas, in appendicitis, the pain remain constant (Alders).

HYPERAESTHESIA IN SHERREN'S TRIANGLE:

Cutaneous hypersensitivity elicited by gently picking up a fold of skin and lifting it off the abdomen or by simply scratching the abdominal wall with finger, in the 'Sherren's triangle' (This is formed by lines joining the umbilicus, right anterior superior iliac spine and symphysis pubis), presence of hyperesthesia in this triangle indicates gangrenous appendix.

AARON'S SIGN:

A sensation of pain and or distress in the epigastric or precardial region on pressure over McBurney's point in appendicitis.

BASTEDE'S SIGN: [A sign described in a case of appendicitis mentioned to be condemned].

When colon is inflated with air through a rectal tube, pain and tenderness can be elicited in RIF in a suspected case of appendicitis. Such maneuver carries risk of perforation and hence should not be entertained.

RECTAL EXAMINATION:

Its primary purpose is to exclude lesions such as ovarian cyst or tubal pathology in females. A second purpose is to elicit tenderness in cases of pelvic appendicitis. In about one in three patients with inflamed appendix in or adjacent to pelvis, the presence of a mass or tenderness specifically localized to right side may be elicited.

In those few patients, in whom the inflamed appendix lies wholly within the pelvis, tenderness on rectal examination may be the only positive physical sign.

VAGINAL EXAMINATION:

It is done to rule out any PID and ruptured ectopic gestation in some female patients with signs and symptoms of acute appendicitis.

LABORATORY INVESTIGATIONS:

Acute appendicitis is one condition where laboratory investigations do not establish the diagnosis because it is based primarily on clinical grounds. Laboratory is a good servant but a poor master (Boyd) holds true in case of acute appendicitis.

TOTAL WBC COUNT AND DIFFERENTIAL COUNT:

Moderate leucocytosis ranging from about 10,000 to 18,000 cells / cu.mm with neutrophilia is the common picture in acute appendicitis. With normal total and differential count, the diagnosis of acute appendicitis is still a possibility. If WBC count is more then 18,000 cells / cu.mm or if the shift to left is extreme, perforated appendicitis or an acute inflammatory disease of greater magnitude than appendicitis is probable. Leucocytosis is usual, but by no means inevitable and seldom diagnostic (fowler).

ANAEMIA AND BLOOD IN THE STOOL:

Suggest a primary diagnosis of carcinoma of caecum, especially in the elderly individuals.

URINE ANALYSIS:

Specific gravity may be high because of dehydration. If the inflamed appendix lies near the bladder or ureter, white cells and occasionally even RBC's may be seen in urine. Bacteriuria in a fresh catheterized urine is not seen in acute appendicitis, thus enables us to differentiate from UTI.

STOOL EXAMINATION: It is useful in helminthiasis.

PHOSPHOLIPASE A2, C-REACTIVE PROTEIN, AND WHITE BLOOD CELL COUNT IN THE DIAGNOSIS OF ACUTE APPENDICITIS:

Increased WBC, CRP, and PLA2 values do not unequivocally corroborate the clinical suspicion of appendicitis, but if all three values are within normal limits, acute appendicitis could be excluded with a 100% predictive value. PLA2 values show a highly significant correlation with CRP but not with WBC values, which supports the view that PLA2 represents an acute phase reactant.

IMAGING MODALITIES:

XRAY ABDOMEN:

Plain radiographs of the abdomen are not indicated for suspected appendicitis, but these are frequently obtained to investigate more generalized acute abdominal symptoms and signs.

SIGNS OF ACUTE APPENDICITIS ON PLAIN RADIOGRAPHS:

1. Appendicolith (0.5 to 6.0 cms).
2. Sentinel loop: Dilated atonic ileum containing fluid level.
3. Dilated caecum.
4. Widening of proportional fat line.
5. Blurring of proportional fat line.
6. Haziness in RLQ due to fluid and edema.
7. Scoliosis: Concave to the right.
8. RLQ mass indenting caecum.
9. Blurring of Right Psoas outline - unreliable.
10. Gas in appendix(rare) - unreliable.

BARIUM ENEMA:

Positive findings are non - filling or partial filling of the appendix often associated with extrinsic pressure effects (reverse '3' sign) on the caecum.

UTRASONOGRAPHY FOR DIAGNOSING APPENDICITIS:

Abdominal sonography was first performed in 1981 to demonstrate appendicitis.

Deutsch reported a 22 cm x 4 cm oblong-shaped mass in the right Lower quadrant with peripheral anechoic structure and a more central hyperechoic area, containing within it an anechoic tube.

In 1986, **Puylaert** described Grade compression technique.

Abu Yousef et.al. proved that a normal appendix could also be visualized. This was also confirmed by other studies.

Jeffrey et. al. studied 250 cases of acute appendicitis and laid down sonographic criteria for diagnosis.

Crady et.al. Performed graded compression sonography in children with suspected appendicitis and observed that a positive compression sonograhy made the diagnosis 50 times more likely in children.

Lim et.al. Performed graded compression ultrasonographic examination in pregnant women and reported a sensitivity of 100% and a specificity of 96%.

Hayden et. al. described the sonographic diagnosis of perforated appendicitis in 133children.

Quillin et. al. observed the following features in appendicular perforation.

► A longer duration between the onset of symptoms and diagnosis.

► Ultrasound: Loss of integrity of the echogenic mucosal layer & findings of localized and mesenteric lymphadenopathy were suggestive of perforation.

The severity of appendicitis was classified according to the layer pattern of the appendiceal wall as described by yuasa in 1986. In brief, the wall of the appendix appears as in four layers from inside to outside as follows:- (a) Hypo echoic, (b) Echogenic, (c) Hypo echoic and (d) Echogenic.

The inner echogenic layer corresponding histologically to the sub mucosal layer. Severity of appendicitis was classified into 4 grades based on the appearance of the echogenic sub mucosal layer. As the intensity of the inflammation increases, the appearance of the sub-mucosal layer is transformed according to the following series:

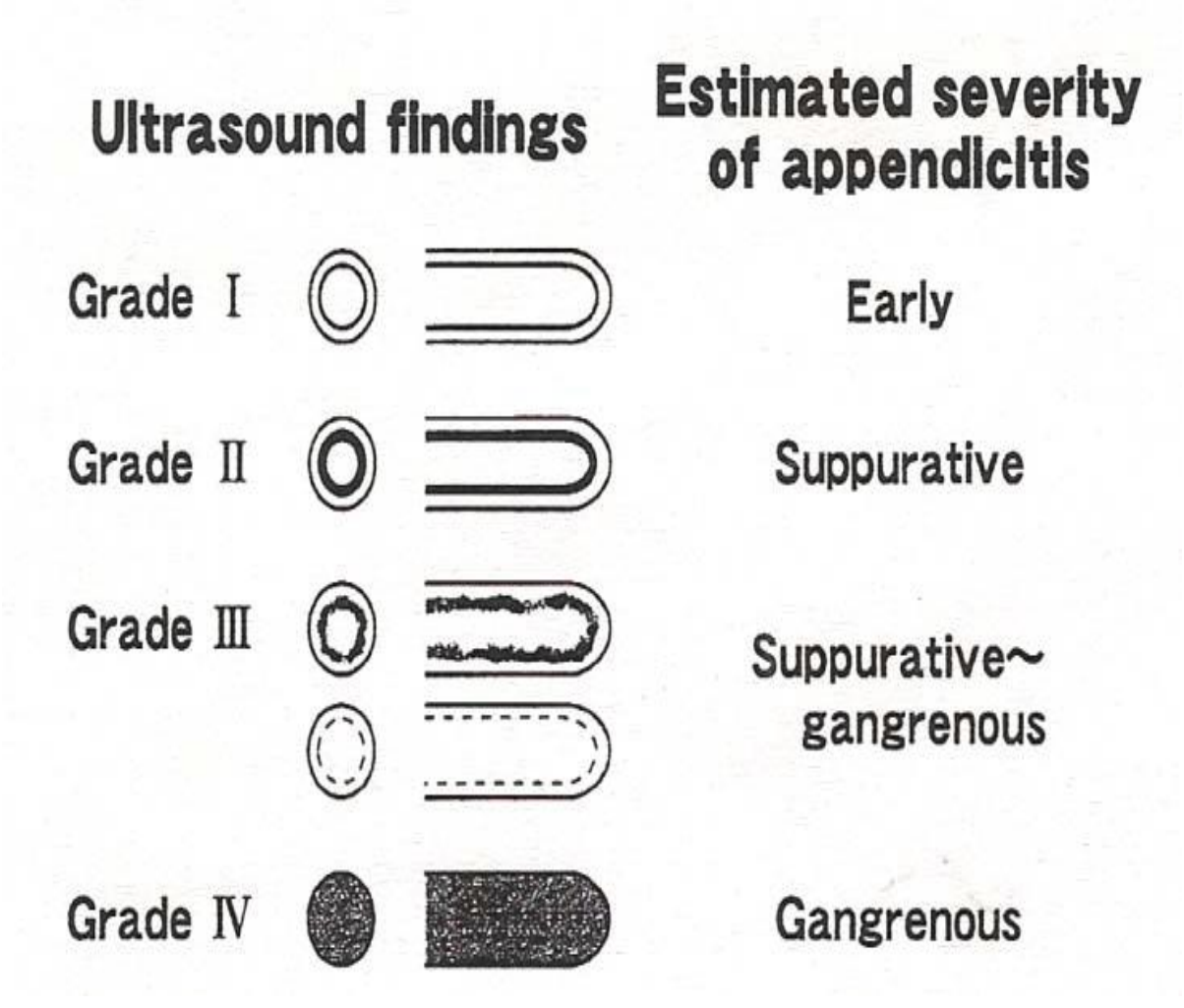
Grade I : Thin and smooth,

Grade II: Thick and smooth,

Grade III: Thick and irregular or thin an intermittent,

Grade IV: Un-identifiable, with amorphous inner structures.

GRADES OF APPENDIX ON USG



THE PATHOLOGIC CORRELATION IS AS FOLLOWS:

Grade I : predicts early appendicitis,

Grade II : predicts mild suppurative appendicitis,

Grade III : predicts severe suppurative appendicitis and

Grade IV : predicts gangrenous appendicitis.

COLOUR DOPPLER:

Colour Doppler sonography is considered positive for appendicitis if increased vascularity was noted in the appendiceal necrotic or perforated appendix.The depiction of hypervascularity in loculated periappendiceal fluid collections and periappendiceal soft tissues was also noted as confirmatory evidence of perforation.

COMPUTED TOMOGRAPHY IN APPENDICITIS:

A number of large prospective trials have demonstrated that CT is a highly accurate test for confirming or excluding appendicitis. CT signs of appendicitis include an appendix measuring greater than 6 mm in diameter, failure of the appendix to fill with oral contrast medium or air up to its tip, appendicolith and enhancement of its wall with IV contrast medium . Surrounding inflammatory changes include increased fat attenuation, fluid, phlegmon, caecal thickening, abscess, extraluminal gas and lymphadenopathy.

Luminal contrast or air in the caecum pointing towards the obstructed origin of the appendix has been called the arrowhead sign, and is present in 30 percent of cases of appendicitis. Focal caecal thickening due to oedema at the origin of the appendix is referred to as a caecal bar. Debate still rages over the use of CT and US in the setting of suspected acute appendicitis, and local practice will depend on the surgeons, radiologists and the availability of imaging facilities at short notice.

A number of clinical and laboratory based scoring systems have been devised to assist diagnosis of acute appendicitis. The most widely used is ALVARADO scoring system.

When the score is 7 or more than 7, ultrasound or C.T scan are not required for planning emergency appendicectomy. But if score is 5-6 then USG or C.T scan are necessary.

The modified Alvarado score is based on three symptoms, three signs and one investigation. The original score included left shift of neutrophil maturation (score 1) yielding a potential score of 10 but Kalan et al omitted this parameter, which is not routinely available in many laboratories, and produced a modified score.

ALVARADO SCORE (MANTRELS)

	Score
Symptoms	
Migratory RIF pain	1
Anorexia	1
Nausea and vomiting	1
Signs	
Tenderness (RIF)	2
Rebound tenderness	1
Elevated temperature	1

Laboratory	
Leukocytosis	2
Shift to left	1
Total	10

MODIFIED ALVARADO'S SCORING

SYMPTOMS	SCORE
Migratory right iliac fossa pain	1
Anorexia	1
Nausea /Vomiting	1
SIGNS	
Tenderness in right lower quadrant	2
Rebound tenderness in right iliac fossa	1
Pyrexia >37.5 C	1
INVESTIGATION	
Leucocytosis	2
Total score	9

SPECIAL CONSIDERATIONS:

CHILDREN:

Children of age group 10-19 years is most commonly affected by appendicitis and the annual incidence is 20 cases per 10,000 population. Among these ,the lowest incidence (2 case per 10,000) is seen in age group 0-4. But 2/3rd of these age group will present with perforation because of their late presentation. Further the diagnosis is delayed by the disease that mimics appendicitis (mesenteric adenitis, streptococcal pharyngitis, bacterial meningitis,etc). CT scan is a valuable tool in children with equivocal findings.

ELDERLY:

Appendicitis is not common in elderly individuals. But they are more prone to perforation because of their late presentation due to less inflammatory responses. Elderly individuals with equivocal findings should be evaluated with CT scan.

PREGNANCY:

Diagnosis of appendicitis during pregnancy is difficult. Because the gravid uterus displaces the appendix from RIF. The incidence is 1 per 1,400 pregnancies. Frequency is slightly increased during II trimester. Perforation is common in III trimester. Diagnosis is very difficult because the various diseases like ectopic pregnancy, chorioamnionitis, preterm labor, placental abruption, and round ligament pain have the similar presentation. During pregnancy, USG is the most valuable tool to diagnose appendicitis.

IMMUNOCOMPROMISE:

Appendicitis should be consider in the immunocompromised individuals with RIF pain. They are more prone to perforation because of their various differential diagnosis. Patients with appendicitis are treated with appendicectomy, because there is no specific contraindication in these individuals.

COMPLICATIONS OF ACUTE APPENDICITIS:

- Perforation and its consequences.
- Abscess formation and its complications.
    - Appendiculo - cutaneous fistula.
    - Appendiculo - Vesical fistula.
- Diffuse peritonitis.
    - Due to contamination of peritoneal cavity before defensive adhesion formation.
    - Secondary rupture of intra-abdominal abscesses that were produced by ruptured appendicitis.

PERFORATION:

Perforation is a serious complication of appendicitis that results from delay in diagnosis and surgical treatment. Unfortunately, this is not an uncommon complication and it is reported to occur in from 19-32% of patients undergoing operations for appendicitis. Delay in seeking medical attention appears to be the most important factor leading to perforation. 62% of patients with perforation had been symptomatic for more than 24hrs, in contrast to 22% of those without perforation.

Scher reported that the mean duration of symptoms was 2-5 days for those with perforation compared with 1-5 days for those without perforation. Delay by physician in implicating appropriate treatment has been less consistently implicated in allowing perforation to occur.

Silbemem emphasized the time that elapses from admissions to operation; 79% of patients with perforation underwent operation within 6 hours of admission and 93 percent within 12 hours. Scher reported 30.6% perforated cases got operated after 24 hours as compared to 15.4% of non - perforated cases.

Perforation can often be diagnosed pre-operatively. It should be suspected when the duration of symptoms exceed 24 hours. A temperature higher than 38°C and WBC count of greater than 15,000 cells / cu.mm. are both uncommon in non-perforated appendicitis.

A history of diffuse abdominal pain following symptoms confined to RLQ accompanied by signs of diffuse peritonitis on physical examination indicates that free perforation has occurred. If the perforation has been walled-off into an appendiceal abscess, a tender mass can often be palpated in the RLQ. If discomfort makes palpation of the RIF difficult, it is helpful to examine the patient under anaesthesia before the incision is made.

TREATMENT:

Appendicectomy was one of the first intra-abdominal operations performed, and appendicitis has long been a surgically treated disease. Based on the high rate of failure with antibiotics alone, non - operative management of acute appendicitis is not recommended. Antibiotic treatment may only be a useful temporizing measure. There is general agreement on the timing of the operation for three categories of appendicitis mentioned above: Acute Appendicitis without rupture, ruptured appendix with local peritonitis, or phlegmon formation and ruptured appendix with spreading peritonitis. Appendicectomy should be done immediately, as soon as the patient is prepared for early surgical intervention.

PRE-OPERATIVE PREPARATION:

If patient with Acute appendicitis is dehydrated, fluid replacement is necessary to correct dehydration & electrolyte abnormalities. Naso-gastric aspiration is helpful in all patients with appendicitis but particularly in those with peritonitis

ANTIBIOTICS:

Intravenous antibiotics have been shown to reduce significantly the incidence of postoperative wound infection and intra-abdominal abscess. Antibiotics should preferably be administered 30 minutes prior to incision to achieve adequate tissue levels.

EXAMINATION UNDER ANAESTHESIA:

Appendicectomy should be performed under general anaesthesia with the patient supine on operating table. After the patient has been anaesthetized, the abdomen should be carefully and systematically palpated once again on O.T table. On occasion such examination will show the Gallbladder to be the real cause of the patient's symptoms. If a mass is felt, it may, on occasion, be preferable to adopt a conservative approach.

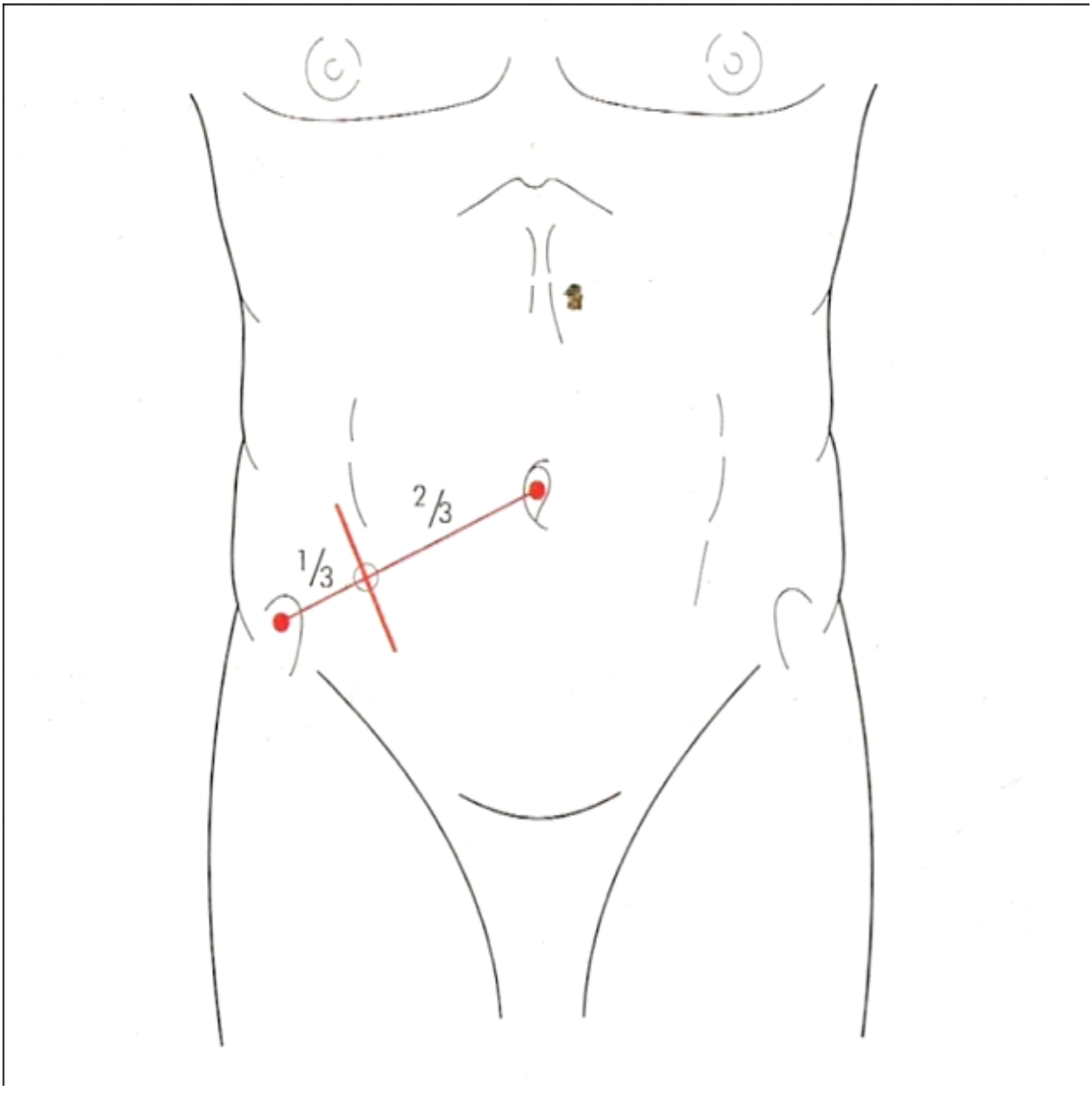
INCISIONS:

Various incisions have been described for appendicectomy. All of them have their own advantages and disadvantages. Any incision should give good exposure, it should allow easy extension if required and should have a good cosmetic value.

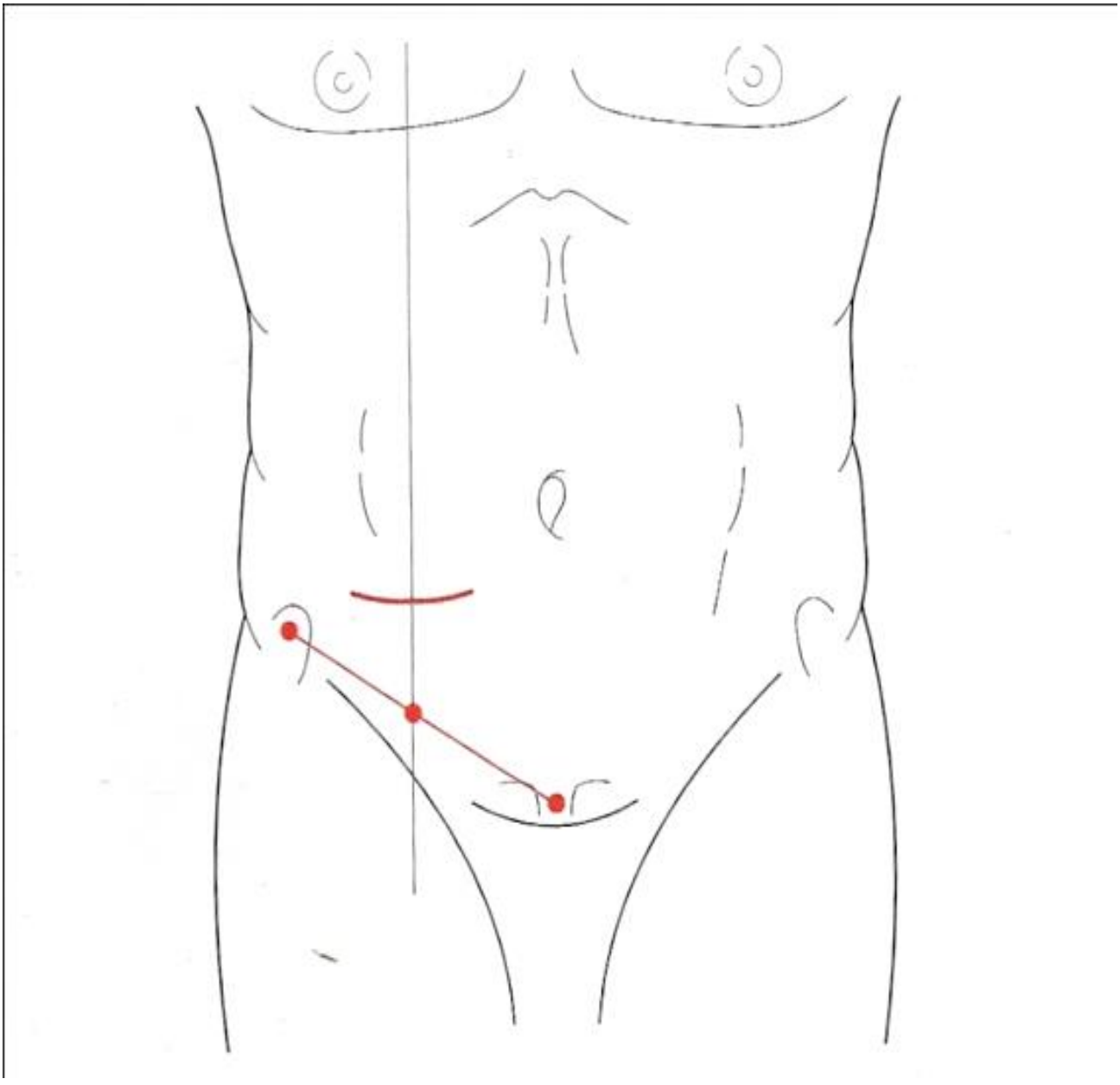
The classic McBurney's incision is typically made at right angles to the line between the umbilicus and the right anterior superior iliac spine at Mc Burney's point. A transverse or Rockey-Davis incision may be used at the same location. An incision made to lie in Langhan's lines results in the best cosmetic result. A lower midline incision may be necessary in morbidly obese patients, or in patients who have a strong possibility of having other pelvic abnormalities.

Other incisions include the vertical Rutherford Morrison's extension, Lanz incision, vertical right para-median or a para rectus (Battle) incision.

GRID IRON INCISION



LANZ INCISION



McArthur-McBurney's grid iron incision is the time honoured muscle splitting incision that probably is most widely used today for appendicectomy. Rightly placed Grid Iron incision falls over the caecum. Its advantage, like that of the Rocky-Davis incision, is that the separation of the muscle in line with their fibers produces a wound that does not entirely depend on sutures for reconstitution of tissue continuity.

Nevertheless, a post operative hernia can occur in both incisions. The Mc Burney's incision provides good exposure when the appendix lies free in the peritoneal cavity. However, if appendix is in another position, particularly retro-caecal, exposure can be awkward. This incision can be extended medially by partially transacting the rectus sheath as described by Weir, but produces a hockey stick type of skin incision.Perhaps the greatest disadvantage of the Mc Burney's incision is that it follows on oblique course in the RLQ, cutting across the skin lines. The scar widens with time, thus producing a cosmetic result that is less than optimal.

The incision 7 – 10 cms in length lies at right angles to the line joining the right anterior superior iliac spine and the umbilicus (Spino umbilical line). Classically, its center should be placed at Mc Burney's point i.e. at the junction of the lateral and middle thirds of that Spino Umbilical line. It is the normal practice, however, to vary the position of the incision according to the supposed situation of appendix, as judged from the site of maximum tenderness or muscle guarding. External oblique aponeurosis is split in the line of its fibers and underlying muscles split to expose transversalis fascia and peritoneum. Both these are picked as one layer and are incised.

If more access is required in a medial direction, the incision is extended as described by Weir. Under desperate circumstances, a Grid-Iron incision can be extended vertically by dividing the oblique muscles at right angles to their fibers; this maneuver (Ruther ford Morrison's muscle cutting incision) destroys the rationale of this incision, but is occasionally necessary to expose a retro caecal appendix.

The **Lanz Incision** is a minor modification of this grid-iron. The skin incision is made more or less transversely and curves so that it lies in the interspinous crease. There after the muscles are divided as in the classical grid iron approach. The method has a definite cosmetic value in producing an almost invisible scar, but difficulties are encountered if the incision to be enlarged. It is the transverse or Rocky-Davis incision that mostly closely meets the criteria for an appropriate incision. Exposure of the appendix through this approach is better than through the grid Iron (Mc Burney's) Incision, particularly in patients with a Retro-caecal appendix and in those who are obese. There is no substitute for good exposure in any operation, and for this reason the transverse incision is preferred.

Transverse incision is centered on the midclavicular – mid inguinal line. It is usually made at a level 1-2 cms inferior to the umbilicus, depending on the size of the patient and the location of maximal abdominal tenderness. The latter probably is the most important determinate for where the incision should lie.

The length of the incision should be 1 to 2 cms longer than the width of the surgeon's hand. The incision is carried sharply through the subcutaneous tissue in order to expose the external oblique aponeurosis and muscle. Subcutaneous bleeding points are clamped with hemostat and ligated using absorbable material or are cauterized using the electro-cautery applied to fine-tipped forceps. The external oblique aponeurosis is split or incised in the direction of its fibers lateral to the Rectus sheath. Beneath this the internal oblique muscle is exposed. The filmy investing fascia overlying this muscle is incised sharply, and the muscles retracted in cephalic and caudal directions along with the external oblique and other superficial tissues. This maneuver exposes the transverse abdominis muscle, which also is split in the direction of its fibers and is retracted to expose the peritoneum lying beneath it. This approach gives rapid access to the right lower portion of the abdomen. If the incision is appropriately placed (i.e. not too low), the exposure of the caecum and the appendix is excellent. This incision produces minimal trauma to the muscle and other tissue, since few if any of the muscle fibers are transacted.

If necessity dictates, the incision is easily extended medially by further incision of the rectus sheath and rarely the rectus muscle itself, converting it into a proper transverse abdominal incision. By so doing, direct visual inspection of the lower abdomen and pelvis can be carried out, and sufficient exposure of the rest of the abdomen obtained to atleast permit exploration by palpation. Consequently, appendicitis & the complications of appendicitis and most of the pathology commonly confused with or mistaken for appendicitis can readily be approached through this incision and extensions.

Further, the incision lies in the direction of the skin line and yields a scar that is cosmetically superior even if circumstances dictate that it cannot be closed primarily.

However, there is a theoretical objection to the transverse incision. The medial end of the incision is relatively close to the midline, so that if localized pus is present and spillage occurs, there is danger of dissemination. By incising the rectus sheath, one can exposes another tissue plane to subsequent infection should contamination take place while these theoretical objections exists and one debated, experience has not shown them to be of clinical significance.

Although some surgeons continue to use a vertical right Para median incision or a para rectus (Battle) incision, these are primarily of historic interest only. Neither incision provides as good access to the appendix as that achieved through either the Rocky-Davis or the Mc Burney's incision.

The battle incision is particularly susceptible to disruption, either acutely as a dehiscence or subsequently as a ventral hernia. It is likely to denervate substantial segments of the rectus muscle as well as to interrupt blood supply to it. If there is doubt about the diagnosis such that a general exploration of the abdomen is indicated, a midline vertical incision is most appropriate. Appendicectomy usually can be done through such an incision, although exposure is not ideal. If gangrenous or perforated appendicitis is encountered, the midline incision can be closed and a more direct approach made to the appendix.

APPENDICECTOMY:

After the peritoneum is opened it is important to look for any exudates in the peritoneal cavity. It may either be due to peritoneal contamination or local reaction to peritoneal inflammation. A purulent fluid suggests peritoneal contamination but a colourless or slightly turbid fluid suggests peritoneal reaction. A sample is then drawn for culture of the fluid. The likelihood that culture results will truly change clinical management, the value of culturing any fluid seen on entry into the abdomen is questionable . All the exudate in the vicinity of the wound should be removed by gentle swabbing or by use of suction.

EXPLORATION OF THE APPENDIX:

The caecum can be distinguished from the small intestine by its large caliber, by its whitish colour, and most distinctively by its longitudinal taenia. The caecum must be distinguished from the transverse colon (Which may be withdrawn in mistake for caecum especially in visceroptic patients), to which the omentum is attached, and from the sigmoid colon, on which are found appendices epiploicae. A finger placed into the peritoneal cavity may be sufficient to identify and then deliver the appendix into the wound. If necessary, the anterior taenia of the caecum can be followed by gently grasping the caecum with moistened gauze and delivering it into the wound, using a rocking motion, until the base of the appendix is identified. If the appendix is retrocaecal, medial mobilization of the caecum is necessary to access the appendix.

This can typically be done bluntly with a finger, combined with sharp or electrocautery division of the tissue along the white line of Toldt. In uncomplicated appendicitis, if the appendix is not adhered to surrounding structures, it often pops free into the operative field (Good Morning appendix).

MOBILIZATION OF APPENDIX:

It is done by careful finger exploration of the surrounding area to break the thin and fibrinous adhesions. It is combined with gentle traction on the tip of the caecum & at the base of the appendix.

This maneuver will frequently serve to deliver the appendix into operative field. One should also take great pains to avoid injury from fracturing the appendix or from causing unnecessary bloody, blunt dissection of the tissues surrounding adherent inflamed appendix. Clearly, the most frequent cause of difficult appendicectomy is inadequate exposure. If exposure is a problem as may be the case in an obese patient, it is safer to extend the incision or in some circumstances, to abandon the local incision and make a midline incision rather than be caught into uncontrolled and unnecessary haemorrhage, injury and other complications. Sometimes, as the result of previous inflammation, the appendix is sharply kinked and is bound down by adventitious bands to the RIF or to the brim of the pelvis. Such bands can be divided with safety and without risk of causing haemorrhage if the knife is kept to the lateral side of the appendix.

When the appendix is located in retro-caecal or retroperitoneal positions, it may be difficult to mobilize the caecum and the appendix. In such case, sufficient exposure becomes even more important. The incision is extended medially and perhaps slightly laterally, and the lateral reflexion of the peritoneum over the right colon is visualized. Careful sharp dissection under direct vision is carried out along with the lateral aspect of the right colon and caecum as one would do for a proper mobilisation of the right colon. Again meticulous attention is paid to homeostasis. This mobilization of the caecum and proximal right colon is usually sufficient to expose the retroperitoneal appendix.

Once the appendix is mobilized, the edges of the wound are protected with proper packing, and handling of the appendix should be kept to an absolute minimum. The upper end is grasped circumferentially with Babcock clamps, and the mesoappendix is identified. The bands and adhesions are divided sharply with scissors. The mesoappendix is then divided between hemostats. The individual sections of the mesoappendix are then ligated with 3-0 absorbable suture or thread. When the mesentery of appendix is edematous, gangrenous, and or fatty, the ties must be applied with particular care to avoid cutting through all the encompassed tissues. The advantages of absorbable suture material are that it will not provide a residual nidus for infection. If the meso-appendix is short and edematous, it may be necessary to clamp and divide it within the peritoneal cavity. When the inflammatory process has extended into the meso-appendix, this structure should be clamped and divided as far away as possible from the appendix, since the septic thrombosis of its vessels may lead to pylephlebitis.

When the appendix has been mobilized sufficiently, the vascular arcade is divided between clamps and tied. This may be done in one step, at the base of the appendix, or, if the anatomy dictates, may be done in stepwise fashion along the mesoappendix, allowing for progressive mobilization along the length of the appendix until the base is reached. The base of the appendix must be definitively identified at the caecum to avoid partial appendicectomy (as has been reported in the literature, particularly associated with laparoscopic techniques).

The appendix is then crushed with a straight clamp approximately 3 mm from the caecum .The straight clamp is then moved approximately 3 mm more distally onto the appendix and applied. The appendix is then ligated using a 2-0 or 0 ligature. A scalpel is used to transect the appendix on the proximal side of the straight clamp, thus avoiding any spillage from the appendix. This same scalpel may be used to cauterize the exposed mucosa of the appendiceal stump, and then removed with the specimen off the surgical field, minimizing contamination. Inversion of the appendiceal stump is of questionable utility. when done, it can be simply accomplished using a purse-string or "Z" stitch placed around the base of the appendiceal stump. Irrigation of the peritoneal cavity with normal saline is typically performed, especially in patients with murky abdominal fluid, gangrenous appendicitis, or frank perforation. There are little data in the literature supporting or refuting this practice. There is no role for prophylactic drainage of a simple case of acute appendicitis.

STEPS OF OPEN APPENDICECTOMY

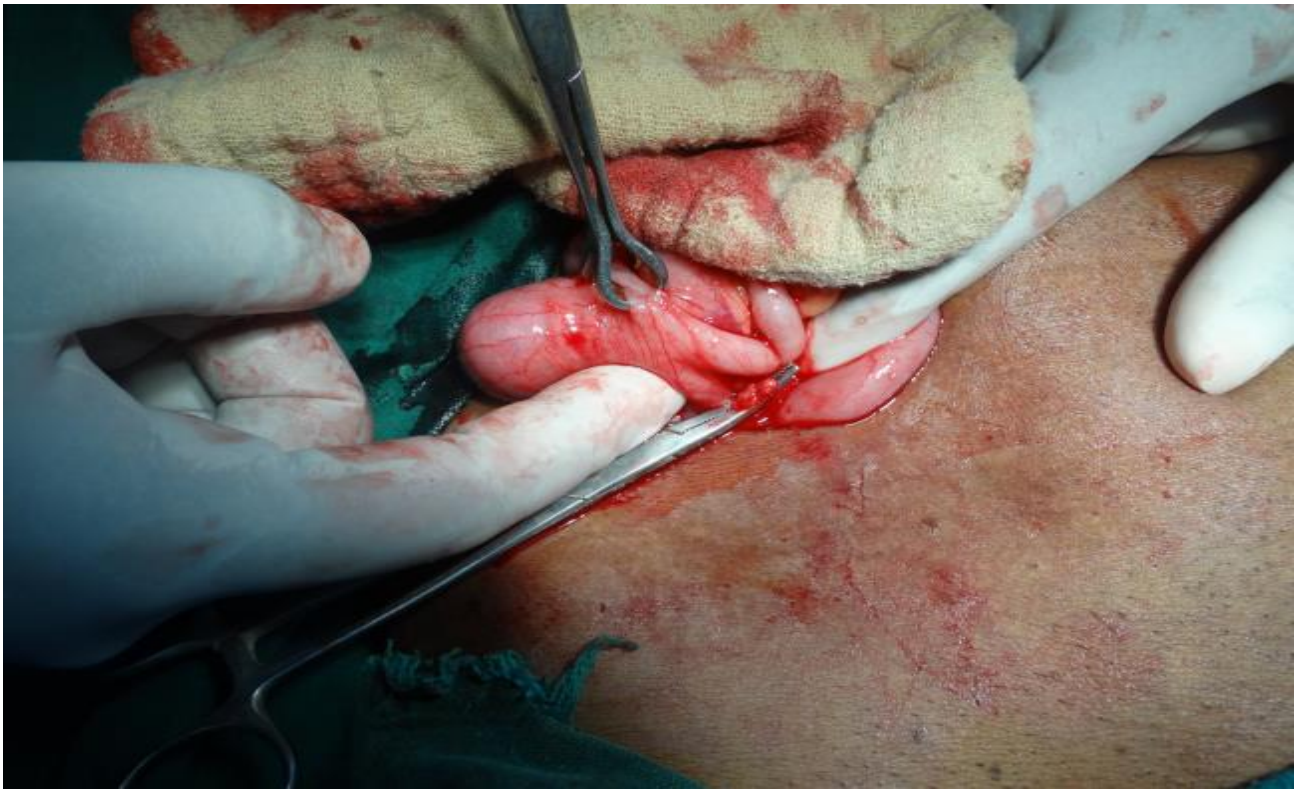
Mc BURNEY'S INCISION

SPLITTING OF EXTERNAL OBLIQUE APONEUROSIS

SPLITTING OF MUSLE LAYER

OPENING OF PARIETAL PERITONEUM

DIVISION AND LIGATION OF MESOAPPENDIX



CRUSHING THE BASE OF APPENDIX

DIVISION OF APPENDIX

STUMP OF THE APPENDIX

SKIN CLOSURE

The appendix together with the knife, swab and forceps, which have been contaminated by contact with the mucosa, are placed in a bowl and are removed from the field of operation. Then the specimen of appendix is sent for histopathological examination to confirm the diagnosis.

RETROGRADE APPENDICECTOMY:

If the exposure of the appendix is difficult either because it is excessively long or because it is densely adherent and inflamed distantly, the meso-appendix can be transected in a retrograde manner beginning at the base of the appendix. This is especially likely to occur when the appendix occupies the retro-caecal position, when its distal end may even be buried with the serous coat. Adherent omentum - when the omentum is firmly wrapped round the appendix, no attempt should be made to separate it from appendix. Instead, it should rather be ligated and divided a short distance away, and the adherent part removed along with the appendix.

WHEN INVAGINATION OF THE STUMP IS DANGEROUS?

If the caecal wall is edematous and turgid, and inversion of the appendix appears difficult, the base of the appendix can be doubly ligated with 2-0 absorbable suture and left as it is. There is no evidence to indicate that the technique increases the incidence of septic complications. However, it is important not to leave mucosa exposed, because it may cause an intense inflammatory reaction in the surrounding peritoneum and may lead to a fistula, **exposed mucosa is readily destroyed with electro-cautery**.

WHEN EVEN, LIGATION OF THE STUMP IS IMPOSSIBLE:

In rare situations of advanced appendicitis, the tissues at the caecal appendiceal junction may be involved in the suppurative and necrotic process. The surrounding tissues are so friable, indurated and turgid, that not only inversion but also simple ligation of the stump is impossible. No attempt should be made to try to close the caecum or to dissect it from the surrounding adhesions. The base of the appendix should be transected, and at that site the caecum should be intubated with an appropriate size Foley catheter and the balloon inflated. The catheter is then brought out through the abdominal wall incision along with appropriately placed drain. In the circumstances in which the caecum is mobile and free from surrounding structures, but a tube caecostomy is necessary because of the nature of the appendiceal stump, the caecum should be fixed to the parietal peritoneum with multiple sutures to avoid a route for peritoneal contamination from the inevitable leakage of stool around the catheter. The tube is left in place until the incision and if present abscess cavity spontaneously close about it.

METHODS OF DEALING WITH APPENDICEAL STUMP:

There are three methods of dealing with appendix stump. Probably the most common is to crush and ligate the stump and then invaginate it into caecal wall by means of a purse-string or ‘Z’ suture.

However some surgeons prefer to omit the step of invagination, while others (ochsner and lilly, 1937) omit the ligature and merely invaginate the ligated stump.

WOUND CLOSURE:

After removal of the appendix, the area of the caecum, the RIF, and the margins of the wound are irrigated copiously, initially with saline solution and then with dilute antibiotic solution (500 mg of kanamycin and 50,000 units of Bacitracin in 500 ml of saline). Irrigation should be repeated after closure of each fascial layer or after closure of the muscles and aponeurosis. Closure of the peritoneum is not necessary and may promote formation of adhesions. Each fascial layer is closed with non-absorbable sutures or 2-0 chromic catgut, skin closed using non-absorbable sutures.

LAPAROSCOPIC APENDICECTOMY:

In 1983, Kurt Semm, a German gynaecologist, who first reported the laparoscopic appendicectomy

INDICATIONS:

The indications for laparoscopic appendicectomy are the same as those for open appendicectomy. A laparoscopic approach provides the surgeon with a tool not only to rule out appendicitis, but also to inspect other organs simultaneously to determine the true cause of the patient's symptoms. The indication for laparoscopic appendicectomy in complicated or perforated appendicitis is controversial.

The overall complication rates are comparable and several studies suggest a lower wound infection rate and reduced hospital length of stay. As expected, the conversion rate in these patients typically ranges from 20% to 30%.

PREOPERATIVE PLANNING:

The patient should be hydrated with intravenous fluid. Administer the first dose of antibiotics preoperatively. A nasogastric tube may be required in the presence of ileus, generalized peritonitis, or repeated vomiting. A Foley catheter is needed to decompress the bladder.

CONTRAINDICATIONS:

The most common contraindication to performing laparoscopic appendicectomy is lack of surgeon experience.

Absolute contraindications include the inability to tolerate general anaesthesia, refractory coagulopathy, and diffuse peritonitis with hemodynamic compromise.

Relative contraindications include previous abdominal surgery with extensive adhesions, portal hypertension, severe cardiopulmonary disease, and advanced pregnancy.

TECHNIQUE:

The patient is placed in supine position with the left arm tucked. A 1- to 2-cm vertical incision is made infraumbilically and deepened to the midline fascia.

A 12-mm trocar is introduced into the peritoneal cavity using either Hassan or Veress technique & pneumoperitoneum is created. A 5-mm port is placed in the midline suprapubically, taking care to avoid injury to the bladder, and another 5-mm port is placed in the LLQ.

A 5-mm 30° laparoscope is inserted through the LLQ trocar. Laparoscope is placed in the LLQ allows triangulation of the appendix in the RLQ by instruments inserted through the two midline trocars. Identification of the appendix is made at the caecal base. Using the combination of blunt and sharp dissection supplemented with electrocautery, adhesions to surrounding structures are lysed. In a case of retrocaecal appendix, lateral peritoneal attachments is divided to improve visualization.The appendix or mesoappendix is retracted anteriorly with a Babcock clamp placed through the suprapubic port. At the appendiceal base ,a window is created in the mesoappendix. The base of the appendix should be dissected adequately so that it can be divided without leaving a significant stump.

GIA stapler or endoloop is used at the appendiceal base & mesoappendix to divide them. Appendicectomy is done in antegrade or retrograde fashion. To reduce the post operative wound infection, retrieval bag is used to remove the appendix. After obtaining the complete hemostasis, pneumoperitoneum is released. Port sites are closed in layers.

APPENDICITIS WITH A PALPABLE MASS:

Appendicular mass may be due to: (1) Peri-appendiceal phlegmon without perforation, or (2) collection of fluid and pus associated with gangrene or localized perforation of the appendix, or (3) To a frank peri-appendiceal abscess.

Management of the patient with a mobile peri-appendiceal mass and symptoms of five days duration or less:

Are presumed to have a gangrenous or locally perforated appendix.

Appendicectomy is the treatment of choice for these patients.

Management of the patients with a fixed peri-appendiceal mass (presumed appendiceal abscess):

If there is a fixed peri-appendiceal mass, especially in the presence of symptoms of more than five days duration, the patient may be presumed to have a peri-appendiceal abscess or phlegmon. If the patient is first seen when symptoms are subsiding and a well localized peri-appendiceal mass is found by physical examination, it is reasonable in most adults to institute expectant treatment

Conservative Ochsner Sherren Regimen:

1. Administration of I.V. Antibiotics and I.V. Fluids.
2. Record of PTR (Pulse, Temperature & Respiratory rate every 4th hourly).
3. Frequent examination of the patient: - Careful record of his condition, extent of the mass noted by regular abdominal examination and mass was marked with skin pencil.
4. A contrast - enhanced CT abdomen in performed. If abscess is present is drained radiologically.

However, children, pregnant women, and most elderly patients should not be managed by conservative methods of the appendiceal mass; drainage of the appendiceal abscess should be carried out as soon as the patient can be prepared for operation.

In those in whom conservative treatment is instituted, symptoms will continue to subside, the abdominal mass will progressively diminish in size and disappear with 24 to 48 hours and the patient will subsequently be discharged from the hospital. Initial non - operative therapy for these patients is successful in approximately 90% of cases. Interval appendicectomy is subsequently done 6 to 8 weeks after diagnosis because of the 10% recurrence beyond that time. (Failure of the mass to resolve should raise suspicion of carcinoma or Crohn's disease). In those patients who either get worse under conservative treatment or who do not improve and do not show continued resolution of their appendiceal mass over a 4 to 5 days period, operation and drainage of the appendiceal abscess should be carried out and appendicectomy performed if possible. If the appendix cannot be removed safely when the abscess is drained, interval appendicectomy should be performed 6 weeks later.

MANAGEMENT OF AN ABSCESS:

Typically, patients who present with an appendiceal abscess have had a delay in presentation, a delay in diagnosis, or very rapidly progressing disease.

The presence of a palpable tender mass in the right lower quadrant associated with other signs and symptoms of acute appendicitis, particularly if they have been present for over 48 hours, is consistent with an appendiceal abscess. A CT is diagnostic, and may be therapeutic if combined with guided percutaneous drainage of the abscess.

Controversy arises when the diagnosis of appendiceal abscess is known prior to induction of anaesthesia. Most studies support the use of guided percutaneous drainage of the abscess as appropriate initial therapy, followed by interval appendicectomy 6 to 8 weeks following catheter removal and clinical resolution of infection. Many authors advocate laparoscopic appendicectomy as the best choice for interval appendicectomy. If percutaneous drainage does not result in rapid clinical improvement, surgery is necessary. Patients with extensive disease may develop septic shock if not treated aggressively. Adequate debridement of devitalized tissue, elimination of all intra-abdominal and retroperitoneal loculations and collections, and adequate drainage are required. Severe cases may require ileo-caecectomy.

DRAINAGE OF THE ABSCESS:

The incision for drainage is made just medial to the crest of the ileum at the level of the most prominent portion of the mass. The important principle to follow is to provide extra peritoneal drainage when possible. A transverse incision is made, the muscles are split using the grid iron technique and the lateral edge of the peritoneum is exposed. It is dissected medially so that the mass surrounding the appendix or encompassing the appendix is approached from its lateral and then retroperitoneal aspect.

If the abscess is under great pressure, it usually ruptures spontaneously. If not, a finger can be introduced slowly into the abscess and its loculations disrupted by blunt dissection. The contents of the cavity is aspirated in a syringe, for analysis and culture and sensitivity. Care is taken not to break down adhesions sealing the medial aspect of the abscess cavity from the rest of peritoneal cavity. Appendicectomy is performed only if the appendix is readily accessible through this (extra peritoneal) approach In infants, Appendicectomy should be accomplished in addition to drainage of the abscess. The reason is that the conical shape and broad lumen of the infant appendix promote continued drainage of the faeces from the caecum through the perforation. Accomplishment of appendicectomy at the time of drainage of the abscess is less important in adults, since narrow obstructed lumen of the adult appendix usually prevents retrograde drainage of faeces. If the appendix is not removed when the abscess is drained, interval appendicectomy should be done 6-8 weeks after drainage from the abscess has ceased and the wound has healed. Systemic antibiotics should be continued for atleast five days post-operatively, and longer if clinically indicated. A daily rectal (Pelvic) examination is made commencing with the second post -operative day in order to detect a developing pelvic abscess. The head of the bed should be elevated approximately 20- 30 degree(Semi – fowler position). While this position will not prevent the development of a sub-phrenic abscess, it will promote drainage towards the pelvis and more comfortable for the patient.

Early ambulation is encouraged & the oral alimentation is commenced as soon as tolerated. If after a week or so, the patient is afebrile and shows no signs of complications secondary to the drained appendiceal abscess, continued treatment in a hospital is not strictly necessary, although it often will be found to be more convenient, criteria for discharge are the some as those noted previously for patients with a mobile peri-appendiceal mass. Trans rectal drainage of the abscess is accomplished by placing the patient in the lithotomy position. The anus is dilated gently, and a self retaining retractor is placed in the anus. Digital examination of the area of fluctuation is carried out. Aspiration with a long needle passed through the rectal wall is performed to confirm the presence of the abscess and the absence of intervening bowel loops, the tip of the needle is placed at the tip of the index finger and directly placed on the fluctuant area. The needle is advanced, using the opposite hand gently through the bowel wall and continuous gentle suction is placed on the syringe plunger. When pus is aspirated, the needle is left in place, the syringe removed, and the material sent for Gram stain , aerobic and anaerobic cultures. A pointed clamp is then guided to the site of needle placement, using the index finger as a guide. With gentle yet forceful pressure, the septum between the anterior rectal wall and the abscess cavity is punctured. The clamp jaws are opened to extend the orifice from the rectum into the abscess cavity.

As this is done, the needle is withdrawn from the field. Several soft Penrose drains are guided through this orifice using a long haemostatic clamp and are sutured in place just inside the anal canal.

Post- operatively, the drains are left in place, until they are spontaneously evacuated. Daily digital rectal examinations are begun on the second post-operative day to assure potency of the communication between the rectum and the abscess cavity. These are continued until the cavity is granulated in and the drainage has ceased. The same technique is used for transvaginal drainage of a pelvic abscess with placement of the soft Penrose drains. Again daily pelvic examination is required to assure potency of the communication to the abscess cavity and prevent recurrence.

UNEXPECTED FINDINGS (WHERE APPENDIX IS ABNORMAL):

Although clinical symptoms may have led to a pre-operative diagnosis of acute appendicitis, on occasion the operative finding in the appendix is those of another entity. The presence of yellow-grey bulbous mass in the appendix should suggest the presence of a carcinoid tumour or a mucocele. In the absence of metastasis, simple appendicectomy is sufficient therapy for these lesions. Carcinoma of the appendix or the caecum or an appendiceal metastasis can be associated with appendicitis, patients with a large peri-appendiceal mass or abscess are particularly prone to harbor a hidden cancer, Right hemicolectomy is usually required to manage carcinoma of the appendix or caecum.

The discovery of a markedly enlarged diffusely thickened, and indurated appendix should lead to a suspicion of appendiceal Crohn’s disease especially when the duration of pre-operative symptoms has exceeded five days, simple appendicectomy usually is sufficient treatment.

ERRONEOUS DIAGNOSIS [APPENDIX NORMAL]:

While every surgeon feels somewhat chagrined at removing a "Lilly - white" appendix, the diagnosis of appendicitis is not always clear and a definite number of normal appendices always are going to be excised in many clinical circumstances. As Ravitch has said. "There is only one way to have a 100% accurate diagnosis recorded for acute appendicitis, and that is to wait until they all rupture. Intensive hospital observation of selected patients may reduce, but not eliminate, the incidence of removal of a normal appendix. In the context of removal of a normal appendix, the unfortunate term 'unnecessary appendicectomy' has been used, that only serves to confuse the real issues. A judgment that appendicectomy was "unnecessary" can be made only in retrospect. The removal of a normal appendix in appropriate clinical circumstances never constitutes an unnecessary appendicectomy. A policy of active surgical intervention on the basis of minimal clinical suspicion has been demonstrated to reduce both the morbidity and the mortality of appendicitis. Watchful waiting, however careful it may be, runs the risk of increasing both morbidity and mortality. In addition, cost-benefit analysis supports a policy of a low threshold of suspicion leading to an appendicectomy.

If exploration reveals normal appendix, orderly investigation for the cause of the patient's symptoms must be carried out. The first maneuver is to obtain a specimen of any peritoneal fluid or exudate for a gram stain. This specimen should also be cultured for both aerobic and anaerobic organisms.

The colour of the fluid can be helpful in suggesting the diagnosis (eg. The brownish fluid frequently associated with a perforated ulcer). The caecum is carefully inspected, for in 3 to 5% of patients older than 40 years of age, symptoms mimicking acute appendicitis are due to malignant disease of the colon. The caecum and adjacent ileum are also examined for evidence of a perforated diverticulum or regional enteritis and the ileum is investigated in a retrograde fashion for both regional enteritis and a Meckel's diverticulum. The pelvic organs are palpated and inspected. The intra-abdominal colon is palpated along its entire course. The gallbladder and the duodenum should be examined by palpation in the right upper quadrant.

If enlarged lymph nodes are present in the small bowel mesentery and no other source for the patient's clinical presentation is identified, a representative node should be excised and sent for culture. Surgically remediable pathology is present, a rapid decision should be made as to whether it can be adequately treated with the existing incision or a recognize extension thereof. If it cannot, the incision should be closed, and a proper incision made through which the proper operation can easily be performed.

If PID is found to be the cause symptoms, it is preferable to perform appendicectomy in order to avoid future diagnostic confusion should the pelvic pathology recur.

COMPLICATIONS OF APPENDICECTOMY:

The incidence of post-operative complications in patients with unperforated appendicitis in which the appendix is removed intact is about 5% but it is over 30% in patients with gangrenous or perforated appendicitis. The incidence of perforation is less than 20% in the first 24 hrs of symptoms, but rapidly climbs to over 70% after 48hrs.

Therefore, the surest way to reduce the incidence of complications is to shorten the period of time between the onset of symptoms and removal of the appendix. Hence, all efforts should be made to make a correct diagnosis and accomplish appendicectomy within 24 hours, after the onset of symptoms. The more frequent complications of appendicectomy include wound infection, pelvic, sub-phrenic and intraperitoneal abscesses, faecal fistula, pylephlebitis, intestinal obstruction, appendiceal stump abscess, intussusception of the appendiceal stump, hemorrhage, right direct inguinal hernia.

RECURRENT APPENDICITIS:

Though the existence of chronic ‘grumbling’ appendicitis is disputed, no one can deny the existence of recurrent appendicitis. It is clear that recurrent attacks of appendicitis do occur either in acute form or subacute form. The risk of a recurrent episode of appendicitis following non-operative treatment or simple abscess drainage without appendicectomy is quite about 28%. Recurrent appendicitis may become more frequent as antibiotics are dispensed more freely.

Recurrent attack may be a full-blown appendicitis or milder than the initial attack of RLQ pain. It is not unusual for one or more sub-acute attacks to precede full-blown acute appendicitis. Effective appendicectomy should be undertaken if observation of repeated attacks provides evidence that the patients is suffering from recurrent sub-acute appendicitis or if abdominal X-ray demonstrate presence of Faecolith or a barium enema shows non-filling of obstructed appendix.

CHRONIC APPENDICITIS:

Chronic or grumbling appendicitis as an entity is still the subject of controversy. Many surgeons believe that there is no such organic entity. It has been said that the "appendix" does not grumble. It either screams or remains silent. While chronic infection of the appendix with tuberculosis, amoebiasis and actinomycosis may occur, a useful clinical aphorism states that chronic appendiceal inflammation is not usually the cause of prolonged abdominal pain of weeks or months duration. In order to sustain a diagnosis of chronic appendicitis as justification for appendicectomy in patients with persistent right lower abdominal complaints, the resected appendix must show fibrosis in the appendiceal wall, partial to complete obstruction of the lumen, evidence of old mucosal ulceration and scarring and infiltration by chronic inflammatory cells.

INCIDENTAL AND PROPHYLACTIC APPENDICECTOMY:

Incidental appendicectomy is the removal of the appendix as a routine during other intra-abdominal operations. Prophylactic appendicectomy is the elective appendicectomy performed only in those patients who are thought to be at risk of developing appendicitis.

INCIDENTIAL APPENDICECTOMY :

Opinion regarding the advisability of incidental appendicectomy routinely during other intra-abdominal operations is not unanimous. Incidental appendicectomy is widely performed at the present time. However, the practice has been both questioned and defended, especially in recent years.

The practice is defended as a low morbidity & mortality; technically easy procedure to perform that surely prevents the development of subsequent appendicitis.

One curious finding noted nearly in every reported series concerning incidental appendicectomy is that between 10 and 15% of incidentally excised appendices show evidence of concurrent or antecedent appendicitis. The purpose of incidental appendicectomy is to obviate the future development of appendicitis and its attendant complications. Such risk is smaller than any risk associated with incidental appendicectomy after middle age and certainly in the elderly. With the exception of children aged 4 or less, the mortality of acute appendicitis in patients younger than 65 years of age is approximately 0.1% and in males 25 years of age or older, the possibility of developing appendicitis in rest of their lives is 1%.

The risk approached the same in women aged 20 and over. Therefore, it seems unlikely that there is any statistical benefit for doing incidental appendicectomy in men over 25 years or in women over 20 years of age. Hence, incidental appendicectomy is a reasonable procedure only in children, teenagers and younger adults. Challenge to incidental appendicectomy has been raised on further issues. One is regarding the role of appendix as an immunology competent organ. Second, is the increased risk of malignancy following appendicectomy? Although experiments in selected animal species support the role of appendix as a source of immunologically competent lymphocytes, there is no evidence that the appendix is an important lymphoid organ in men, particularly after age 20, when appendiceal lymphoid tissue atrophies.

PROPHYLACTIC APPENDICECTOMY:

PALPABLE FAECOLITH: There is no data to substantiate one way or another, the validity of prophylactic appendicectomy in the presence of a palpable Faecolith. Clinical experience, however suggests that the presence of a Faecolith in normal appendix does justify its removal.

RADIO-OPAQUE FAECOLITH: Elective appendicectomy should be done, even in asymptomatic patients found to have an Appendicolith (calcified) on radiography. This is because the risk of developing appendicitis and subsequent perforation is high in these patients. In case of persons who are going for mountaineering, Space, they can also undergo prophylactic appendicectomy.

PROGNOSIS:

MORTALITY:

In the past 100 years the overall mortality from appendicitis has dropped from about 26% to about 1%. This has been achieved by better diagnosis and treatment but a cost of about 15 to 20% of operative being performed on people who do not have appendicitis.

Among the factors responsible for decreasing mortality are:-The significantly decreasing incidence of appendicitis, better diagnosis and treatment, attributable to the now available antibiotics, intravenous fluids, blood and plasma and a higher percentage of patients receiving definitive treatment before rupture.

Principle factors in mortality are whether or not rupture occurs prior to surgical treatment and the age of the patient. The overall mortality rate in unruptured acute appendicitis is little higher than the rate for a general anaesthetic (0.06%) and is now about 0.1%. the overall mortality rate in ruptured acute appendicitis is about 3- 5% - 30 to 50 fold increase. In gangrenous appendicitis, mortality risk is about 0.6%.

Age is also an important contributing factor to mortality, as death following appendicectomy is more common in the very young and the elderly, with mortality rates upto 15% in patients over the age of 70. Contributing factors in the elderly include associated disease (primary of the CVS), delay in seeking medical attention and the surgeon's reluctance to operate until the diagnosis is certain.

All increase the likelihood of perforation. It has also been said that perforation occurs more rapidly in the elderly. Infants also have a high rate of perforation owing to their inability to articulate symptoms and the difficulty encountered in performing physical examination. Death is usually attributed to uncontrolled sepsis, peritonitis, intra abdominal abscesses or gram negative septicemia. Sepsis may impose metabolic demands of such magnitude on the cardio vascular or the respiratory systems that they cannot be met, in which case cardiac or respiratory insufficiency is the direct cause of death.

Pulmonary embolism continues to account for some deaths. Aspiration producing drowning the patients vomits in a prominent mode of death in the older age group.

MORBIDITY:

Although the mortality of appendicitis has declined progressively, morbidity from appendicitis continues to be high. Overall, morbidity currently occurs in 10% of all patients with appendicitis. Morbidity rates like mortality rates are precipitously increased by rupture of the appendix and to a lesser extent by old age. ***Wound infections account for one-third of all morbidity***. The presence of gangrene or perforation increases the morbidity risk four of five fold, with wound infection rates of 15 to 20%.

SURGICAL SITE INFECTION

A major SSI is defined as a wound that either discharges significant quantities of pus spontaneously or needs a secondary procedure to drain it. The patient may have systemic signs, such as tachycardia, pyrexia and a raised white count.

Minor wound infections may discharge pus or infected serous fluid but should not be associated with excessive discomfort, systemic signs or delay in return home.

The differentiation between major and minor and the definition of SSI is important in audit or trials of antibiotic prophylaxis. There are scoring systems for the severity of wound infection, which are particularly useful in surveillance and research. Examples are the Southampton and ASEPSIS systems.

SOUTHAMPTON WOUND GRADING SYSTEM

Grade	Appearance
0	Normal healing
I	Normal healing with mild bruising or erythema
Ia	Some bruising
Ib	Considerable bruising
Ic	Mild erythema

II	Erythema plus other signs of inflammation
IIa	At one point
IIb	Around sutures
IIc	Along wound
IId	Around wound
III	Clear or haemoserous discharge
IIIa	At one point only (£2 cm)
IIIb	Along wound (>2 cm)
IIIc	Large volume
IIId	Prolonged (>3 days)
Major complication	
IV	Pus
IVa	At one point only (£2 cm)
IVb	Along wound (>2 cm)
V	Deep or severe wound infection with or without tissue breakdown; haematoma requiring aspiration

THE ASEPSIS WOUND SCORE

Criterion	Points
Additional treatment	0
Antibiotics for wound infection	10
Drainage of pus under local anaesthesia	5
Debridement of wound under general anaesthesia	10
Serous discharge(a)	Daily 0–5
Erythema(a)	Daily 0–5
Purulent exudate(a)	Daily 0–10
Separation of deep tissues(a)	Daily 0–10
Isolation of bacteria from wound	10
Stay as inpatient prolonged over 14 days as result of wound infection	5

(a) Scored for 5 of the first 7 days only, the remainder being scored if present in the first two months.

NORMAL WOUND HEALING

NORMAL WOUND HEALING WITH MILD BRUISING & ERYTHEMA

MINOR WOUND INFECTION

GRADE IV WOUND INFECTION

MATERIALS AND METHODS

A randomized prospective study of 100 patients admitted in **Department of General Surgery, Tirunelveli Medical College & Hospital** with a diagnosis of **Uncomplicated Acute Appendicitis** (intra-operatively) was carried out over a period of two years from September 2012 to August 2014. Cefotaxime 1gm & metronidazole 500mg were given intravenously for all patients ½ hour before surgery. Appendicectomy was carried out in all the patients by the standard protocol of open surgical technique. After performing an emergency open appendicectomy, the patients were randomized into two groups. Group I did not receive further dose of Antibiotics. Post operatively, patients in group II received multi doses of cefotaxime 1gm & metronidazole 500mg intravenously.

INCLUSION CRITERIA:

All patients with age >12 years and intra-operatively diagnosed as Uncomplicated Acute Appendicitis

EXCLUSION CRITERIA:

1. Suppurated appendix
2. Gangrenous appendix
3. Perforated appendix
4. Appendicular abscess
5. Appendicular mass

6. Patients with age ≤12 years
7. Allergic to cephalosporins
8. Prior antibiotic treatment

During the post-operative period, the progress of the surgical wound was monitored on a daily basis for all the patients included in the study. Wound infection was graded using the Southampton scoring system.

SOUTHAMPTON WOUND GRADING SYSTEM

Grade	Appearance
0	Normal healing
I	Normal healing with mild bruising or erythema
II	Erythema plus other signs of inflammation
III	Clear or haemoserous discharge
IV	Pus discharge
V	Deep or severe wound infection

Wound healing was taken as normal for grades 0, 1 and 2. Infection of the wound was categorised as minor for grade 3 and as major for grades 4 and 5. Patients who developed major infection were treated appropriately with daily wound irrigation and antibiotics based on culture reports.

Informed consent was obtained from all the patients and the study was carried out with prior clearance from the ethical committee.

Study parameters:

- Demographic data - age and sex
- Grade of wound infection

Statistical Method:

To describe about the data, Descriptive statistics frequency analysis & Percentage analysis were used for categorical variables and for continuous variables, the Mean & S.D were used. To find the significance, Chi-Square test was used. The collected data was analysed with SPSS 16.0 version.

RESULTS

In our study, 100 patients were included with a diagnosis of uncomplicated acute appendicitis and randomized into two groups, with fifty patients in each group.

The age group varied from 15 to 65 years in this study, with a mean age of 26.13 years .

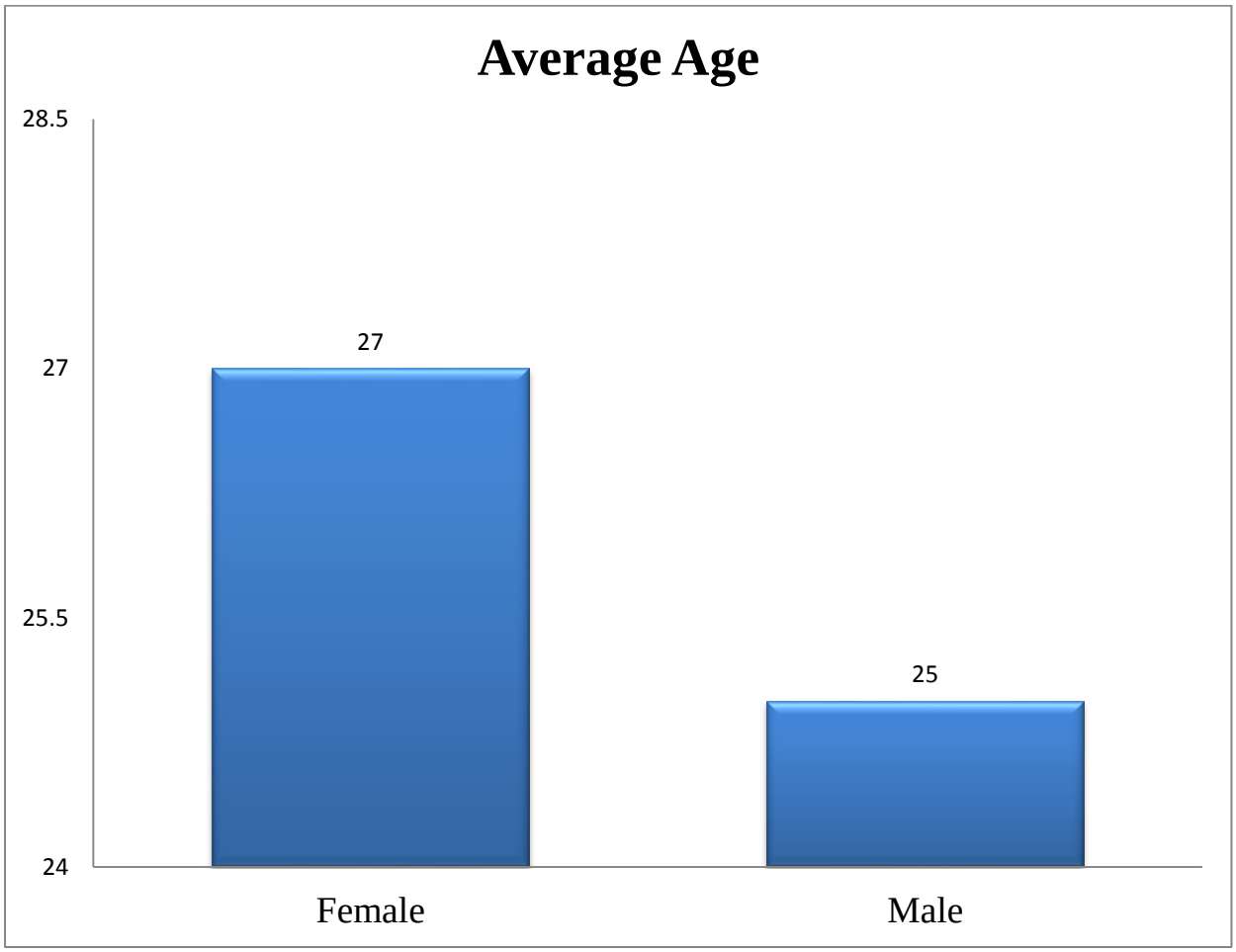
The age group varied from 15 to 65 years in females, with a mean age of 27.23 years.

The age group varied from 15 to 57 years in males, with a mean age of 25.43 years.

No. of patients in both groups	Minimum Age	Maximum Age	Mean Age
100	15	65	26.13

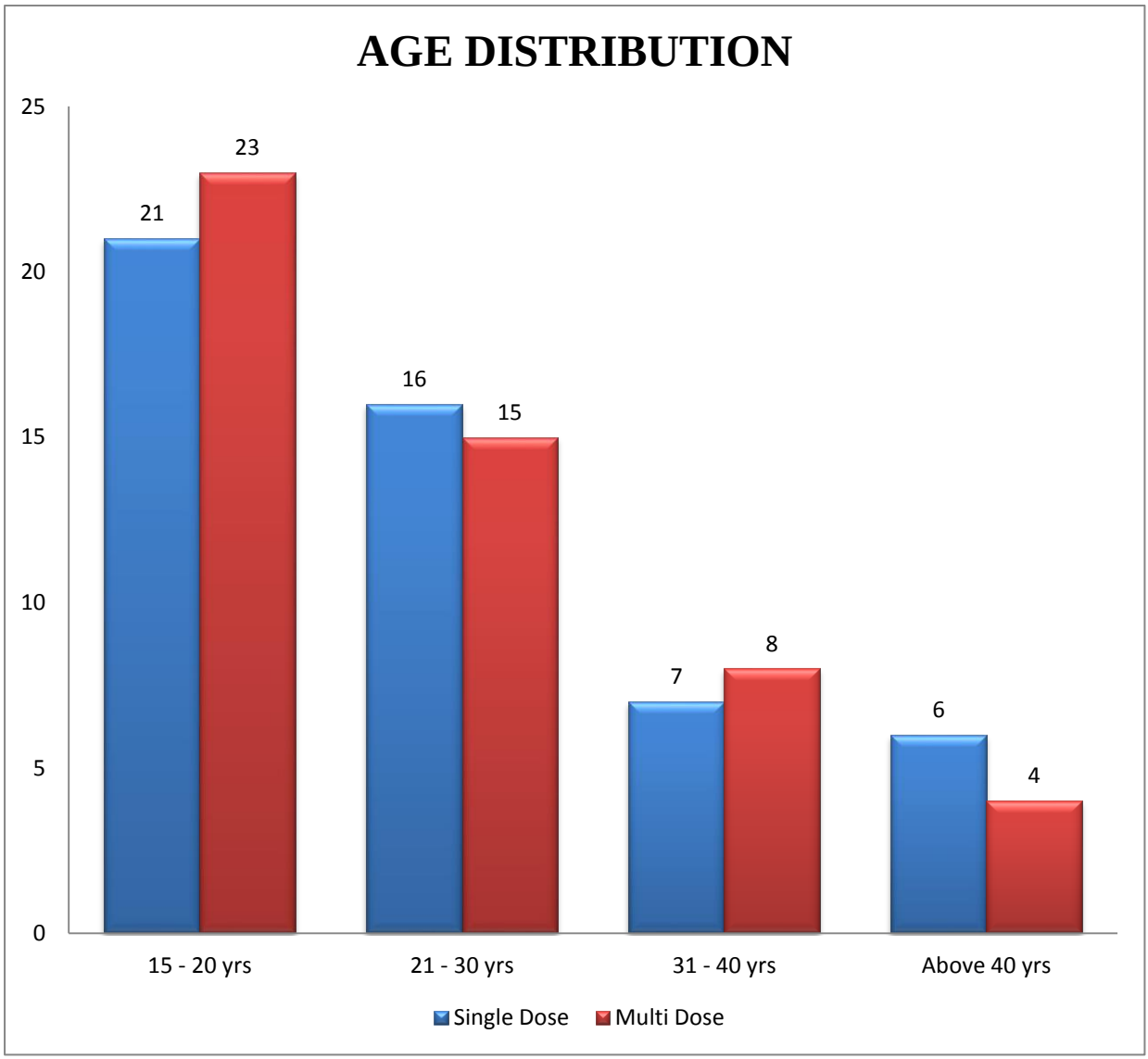
No. of Female patients	Minimum Age	Maximum Age	Mean Age
39	15	65	27.23

No. of Male patients	Minimum Age	Maximum Age	Mean Age
61	15	57	25.43



Age in Years	Single Dose (Group I)	Multi Dose (Group II)
15 - 20 yrs	21	23
21 - 30 yrs	16	15
31 - 40 yrs	7	8
Above 40 yrs	6	4
Total	50	50

Samples are age matched with p=0.899



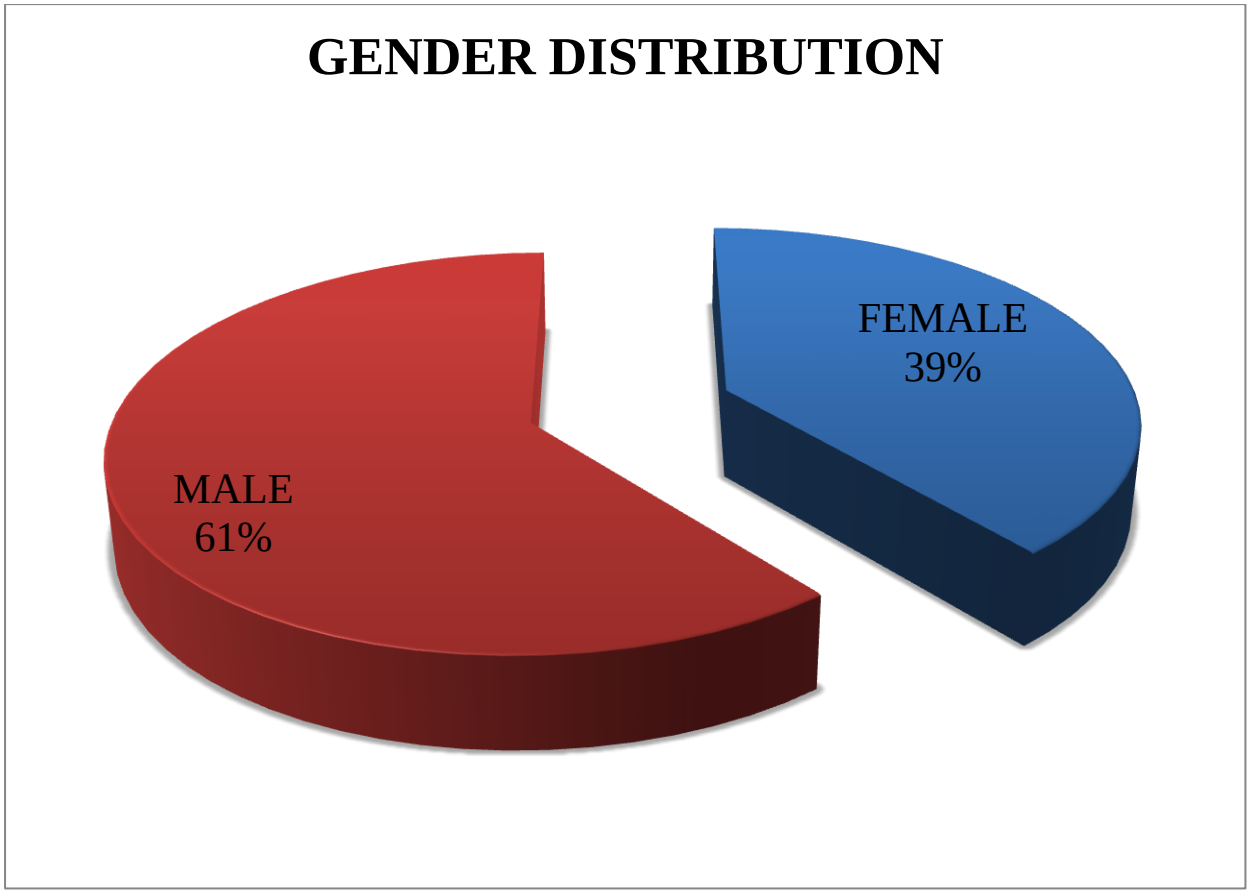
The male to female ratio in this study was 1.56.

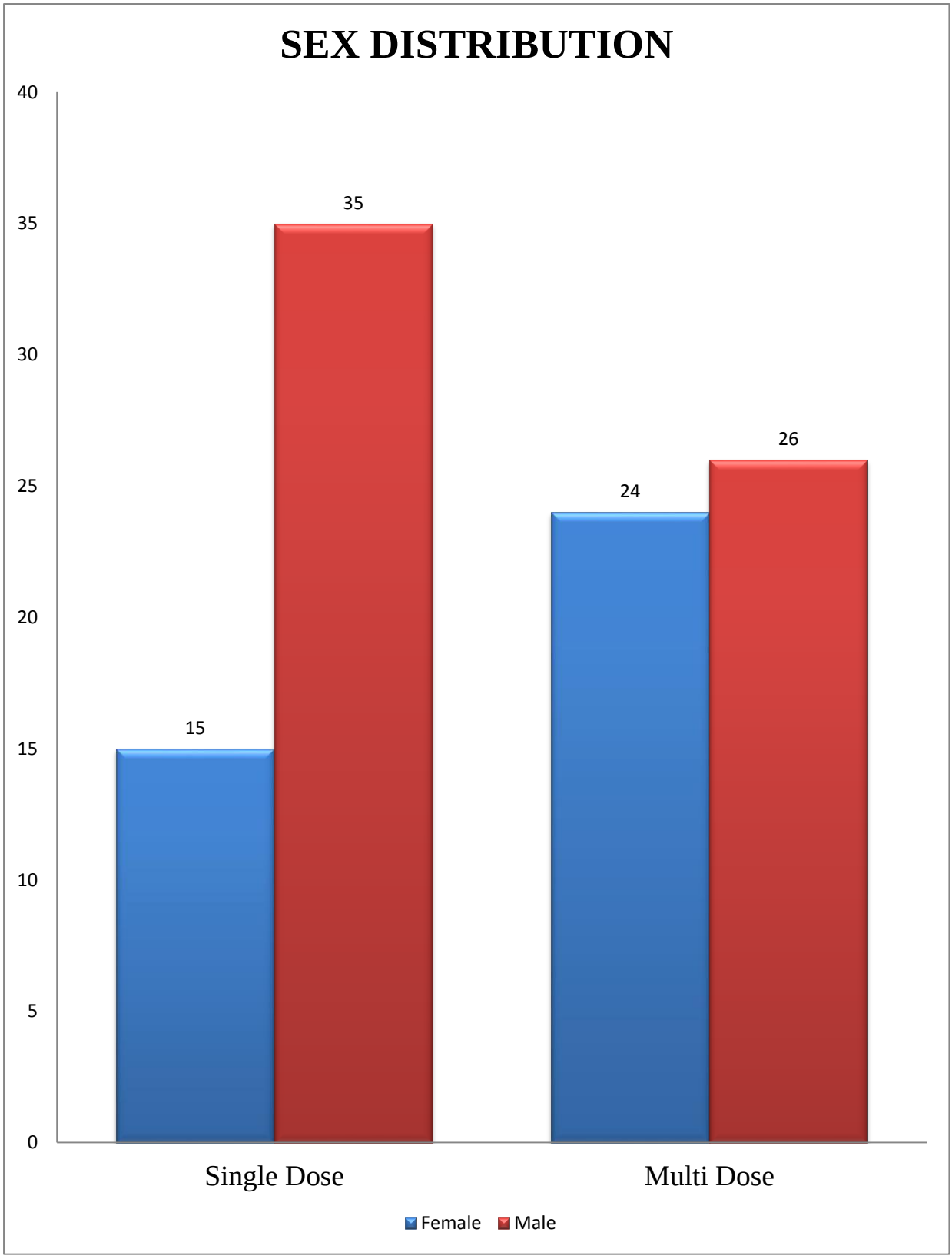
The male to female ratio in group I was 2.33.

The male to female ratio in group II was 1.08.

SEX	SINGLE DOSE	MULTI-DOSE	TOTAL
MALE	35	26	61
FEMALE	15	24	39
TOTAL	50	50	100

Samples are gender matched, p= 0.065




SEX DISTRIBUTION
40
35
30
25
20
15
10
5
0
35
15
26
24
Single Dose
Multi Dose
Female
Male

In the postoperative period, the surgical wounds were examined and graded using the Southampton scoring system.

Normal wound healing was observed in 85(85%) patients in this study.

Normal wound healing was observed in 42(84%) patients in group I.

Normal wound healing was observed in 43(86%) patients in group II.

Minor wound infection was present in 9(9%) patients in this study.

Minor wound infection was present in 5(10%) patients in group I.

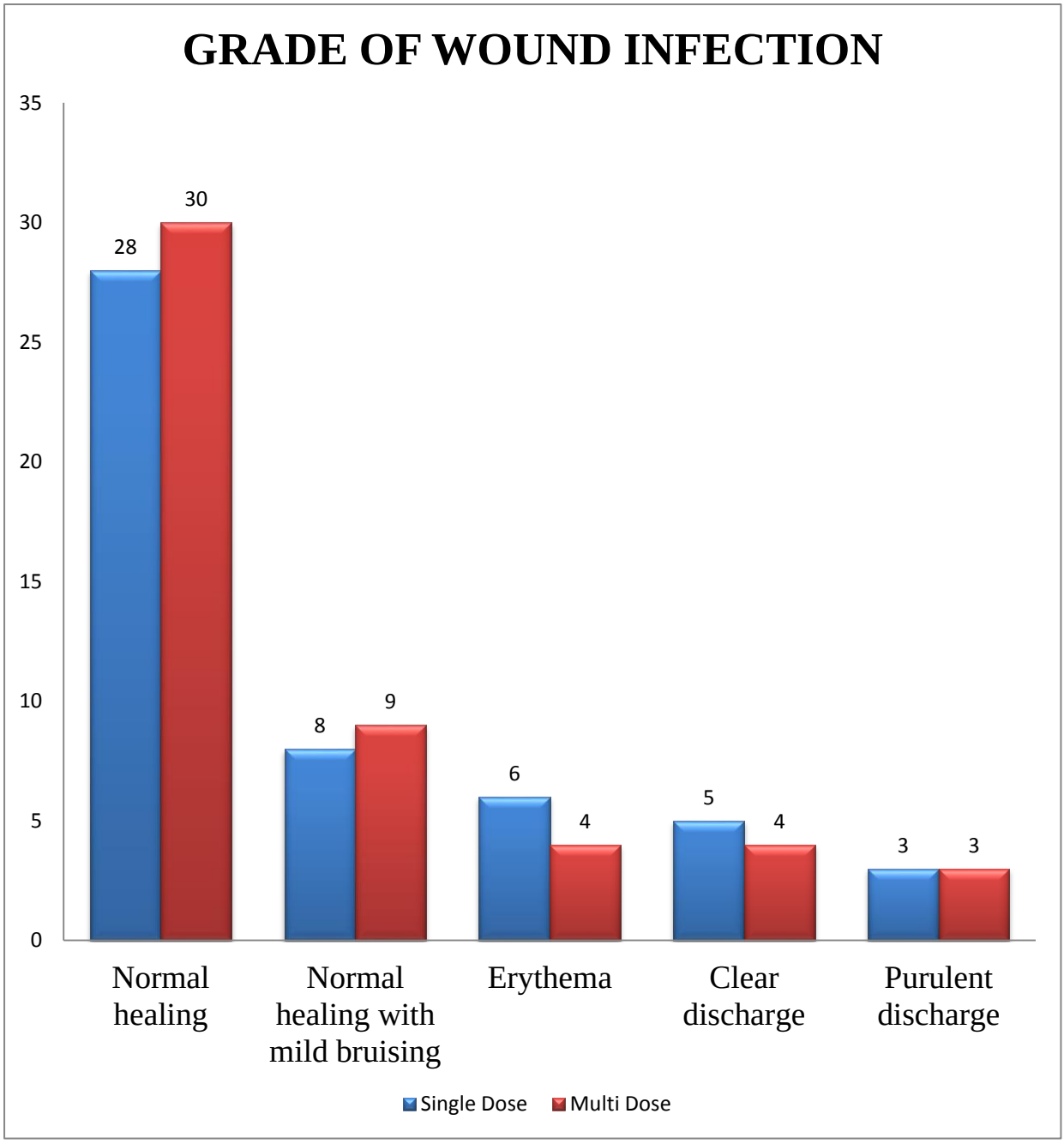
Minor wound infection was present in 4(8%) patients in group II.

Pus discharge was noted in 6(6%) patients in this study.

Pus discharge was noted in 3(6%) patients in group I & group II.

WOUND GRADE	SINGLE DOSE	MULTI-DOSE	TOTAL
GRADE 0	28	30	58
GRADE I	8	9	17
GRADE II	6	4	10
GRADE III	5	4	9
GRADE IV	3	3	6
GRADE V	0	0	0
TOTAL	50	50	100

Wound infection rates across all grades were similar in both groups, p =0.959



Using Chi square test for analysis, the incidence pattern and the grade of wound infections in both the study groups were found statistically not significant(p=0.959).

DISCUSSION

Usage of appropriate antibiotics is well known to control wound infection rates following open appendicectomy for uncomplicated acute appendicitis. While antibiotic prophylaxis is common in surgical procedures, inappropriate use of antibiotics occurs in 25–50% of general elective surgeries. A **Cochrane systematic review** found that antibiotic use in patients having uncomplicated acute appendicitis was superior to placebo in reducing the rates of postoperative complications but concluded that no recommendations can be made regarding the duration of antibiotic use. At the same time, in patients with severe form of appendicitis, it has advised to continue a comprehensive antibiotic regimen, as the risk of infective complications is quite high in this group.

The choice of antibiotic for prophylaxis varies widely in different centres and even among the different surgical units attached to the same Institute. The American Society of Health System Pharmacists (ASHP) recommends cephalosporins as drug of choice for prophylaxis for uncomplicated acute appendicitis and gentamicin with metronidazole only in cases of penicillin allergy. The major controversy lies in the optimum duration of prophylaxis in cases of uncomplicated acute appendicitis. Many studies have shown that single pre-operative dose of antibiotic is as effective as multiple postoperative doses in preventing wound complications following appendicectomy.

A randomized control study by **Mui et al** have shown that single dose of pre-operative antibiotic is adequate for prevention of infective complications of the wound in patients undergoing surgery for uncomplicated acute appendicitis. Their conclusion was that the prolonged antibiotic administration was cost-ineffective and led to unnecessary complications.

In our study, we have used a more objective method to assess the progress of the surgical wounds by correlating with the Southampton scoring system. There was no significant difference (p=0.959) between wound infection rates of the single-dose group (8%) and the multiple dose group(7%). These findings are in full agreement to the similar studies in the literature. Moreover, comparing the incidence of wound infection across all the grades in both the groups by using the Chi-square test has shown no significant difference between the two groups(p=0.959). Cefotaxime & metronidazole was chosen in our study as it was readily available, cheaper and has very good antibacterial spectrum for pathogens causing post appendicectomy sepsis. This choice of antibiotic is in line with the recommendations given by the ASHP.

Many studies have highlighted and repeatedly emphasised the effects of improper choice and inappropriately prolonged duration of prophylactic antibiotics on the rising emergence of antimicrobial resistance among the common pathogens.

Coakley et al, in a recent study, have consistently proven that postoperative antibiotic treatment for uncomplicated acute appendicitis did not reduce infectious complications. In fact, their study showed significantly increased rate of adverse effects like Clostridium difficile infection, diarrhea, longer length of hospital stay and higher treatment cost.

A possible benefit that can be derived from our study is that by using a single pre-operative dose, the surgeon can be certain of having given an effective prophylaxis at induction of anaesthesia without the need to monitor further postoperative doses. Moreover, avoiding further intravenous doses of antibiotics may lead to savings in terms of nursing effort, time , cost of treatment and to reduce antibiotics related adverse effects.

SUMMARY

Appendicitis is the most common intra abdominal condition requiring emergency surgery. Appendicectomy is the commonest surgical procedure in general surgery.

Many randomized and observational studies have shown that appropriate use of antibiotics reduces the risk of infection by 40–60%. Based on prospective clinical studies, guidelines have been established regarding the choice of prophylactic antibiotics, it's timing and route of administration for emergency appendicetomy. However, the duration of antibiotic usage remains a contentious issue and there is no definite consensus among the surgical community.

A randomized prospective study of 100 patients admitted in **Department of General Surgery, Tirunelveli Medical College & Hospital** with a diagnosis of **Uncomplicated Acute Appendicitis** (intra-operatively) was carried out over a period of two years from September 2012 to August 2014.

In this study postoperative wound status was observed in all the patients from II POD till they were discharged and at the time of suture removal. Following findings were observed in this study:

- Normal wound healing was seen in 42 & 43 patients of group I & group II respectively.
- Minor infection was seen in 5 & 4 patients of group I & group II respectively.
- 3 patients developed pus discharge in both groups.

- No patients had developed deep wound infection and other complications of appendicectomy.

Comparing the incidence of wound infection across all the grades in both the groups by using the Chi-square test has shown no significant difference between the two groups(p=0.959).

In our study ,we observed that single-dose pre-operative antibiotics is equally effective to multiple-dose in preventing postoperative wound infection in patients undergoing open appendicectomy for uncomplicated acute appendicitis.

A possible benefit that can be derived from our study is that by using a single pre-operative dose, avoiding further intravenous doses of antibiotics may lead to savings in terms of nursing effort, time , cost of treatment and to reduce antibiotics related adverse effects.

CONCLUSION

It is evident that prophylactic postoperative antibiotics confer no additional benefit over a single pre-operative dose of cefotaxime & metronidazole. With additional benefits of the greater ease of administration and decreased cost, single-dose cefotaxime & metronidazole is the prophylaxis of choice for appendicectomy in patients with uncomplicated acut appendicitis. It is essential for surgeons and surgical departments to update their routine practice of antibiotic prophylaxis to comply with updated guidelines and evidence base.

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PROFORMA

PARTICULARS OF PATIENT:

Name: Case no:

Age: IP.No:

Sex: Date of Admission:

Religion: Date of Operation:

Occupation: Date of Discharge:

Address:

Chief Complaints:

- abdominal pain
- nausea and vomiting
- fever

History Of Presenting Complaints:

Pain Abdomen:

- Duration
- Time of onset
- Mode of onset
- Site of pain
- Radiation of pain

- Character of pain
- Aggravating factors
- Relieving factors

Nausea and vomiting:

Fever:

- Duration
- Type
- Severity

Past History:

- Similar complaints
- Abdominal surgery
- Tuberculosis

Personal History:

- Diet
- Appetite
- Sleep
- Bowel/Bladder
- Habits

Family History:

Menstrual History:

- Menarche
- LMP
- Menstrual cycles

PHYSICAL EXAMINATION:

GENERAL EXAMINATION:

- Build
- Nourishment
- Lymhpadenopathy
- Clubbing

Pallor

Icterus

Cynosis

Pedal edema

VITALS:

- Pulse
- Blood pressure
- Respiratory rate
- Temperature

ABDOMINAL EXAMINATION:

Inspection:

- Contour of abdomen
- Movements of all quadrents with abdomen
- visible pulsation and peristalsis

- Skin
- Hernial orifices
- Umbilicus
- scrotum

Palpation:

- Local rise of temperature
- Local Tenderness
- Pointing sign
- Roving`s sign
- Psoas`s sign
- Obturator sign
- Muscle guarding
- Rebound tenderness
- Mass formation

Percussion:

Auscultation:

Rectal Examination / Per Vaginal Examination:

Examination of Scrotum And Spermatic Cord:

Examination of Regional Lymph Node:

SYSTEMIC EXAMINATION:

Cardiovascular system:

Respiratory system:

Nervous system:

PROVISIONAL DIAGNOSIS:

INVESTIGATIONS:

1. **Complete Blood Count:**

- HB%
- TC
- DC
- ESR

2. **Urinalysis:**

- Albumin
- Sugar
- Microscopy

3. **Biochemical Analysis:**

- Sugar
- Urea
- creatinine

4**. Chest X Ray** & **Plain X Ray Abdomen**:

5. **Ultrasound Abdomen/Pelvis**:

6. **ECG :**

7. **Blood Grouping & Typing:**

Treatment:

Pre Operative Management:

- Nil oral
- Injection T.T
- Informed written consent
- Preparation of parts
- Antibiotics

Operative Management:

- Date of operation
- Anaesthesia
- Operative procedure

POST OPERATIVE WOUND STATUS:

WOUND GRADE	II POD	III POD	IV POD	V POD	SUTURE REMOVAL
GRADE 0					
GRADE I					
GRADE II					
GRADE III					
GRADE IV					
GRADE V					

CONSENT FORM

For Operation / Anaesthesia

I _____ Hosp. No. ____ _____ in my full senses hereby give my complete consent for _____ or any other procedure deemed at which is a / and diagnostic procedure / biopsy / transfusion/operation to be performed on me / my ward _____ age _____ under any anaesthesia deemed fit. The nature and risks involved in the procedure have been explained to me to my satisfaction.

For academic and scientific purpose, the operation / procedure may be televised or photographed.

Date: Signature / Thumb Impression

Name : of patient / Guardian

Designation :

Guardian:

Relationship:

Full address:

S. No.	NAME	AGE	SEX	IP No.	SINGLE DOSE	MULTI DOSE	SOUTHAMPTON WOUND GRADING SYSTEM					
							GRADE 0	GRADE I	GRADE II	GRADE III	GRADE IV	GRADE V
01	Mr.GURUNATHAN	57	M	44074	√	-	√	-	-	-	-	-
02	Ms.SHANTHINI	16	F	44293	-	√	√	-	-	-	-	-
03	Mr.MUTHUMARIAPPAN	26	M	47582	√	-	-	-	√	-	-	-
04	Mr.PAULDURAI	27	M	50388	-	√	-	√	-	-	-	-
05	Mrs.MARIYAMMAL	30	F	50397	-	√	√	-	-	-	-	-
06	Mrs.SYED ALI FATHIMA	27	F	51511	√	-	√	-	-	-	-	-
07	Ms.NANDHINI	16	F	51667	-	√	√	-	-	-	-	-
08	Mr.JOHN STEPHEN	38	M	51738	-	√	-	-	-	√	-	-
09	Mr.MYDEEN ABDUL KADHAR	21	M	54218	-	√	√	-	-	-	-	-
10	Mrs.PARVATHY	64	F	58039	-	√	-	-	-	-	√	-
11	Mr.KARTHIK	21	M	59226	-	√	√	-	-	-	-	-
12	Ms.SUBBHULAKSHMI	15	F	60579	-	√	-	√	-	-	-	-
13	Mrs.SENTHIL SELVI	35	F	64728	√	-	√	-	-	-	-	-
14	Ms.FATHIMA BENASEER	16	F	64734	√	-	√	-	-	-	-	-
15	Mrs.RADHA	30	F	64902	-	√	√	-	-	-	-	-
16	Mr.MUTHU	17	M	64962	-	√	√	-	-	-	-	-
17	Ms.MARAGATHAM	17	F	66008	-	√	√	-	-	-	-	-
18	Mr.KRISHNAN	36	M	66054	√	-	√	-	-	-	-	-
19	Mrs.RASAL AYISHA	27	F	67856	√	-	-	-	√	-	-	-
20	Ms.MUTHARASI	20	F	69043	-	√	-	√	-	-	-	-
21	Ms.MUTHUMARIYAMMAL	17	F	69096	-	√	√	-	-	-	-	-
22	Mrs.KRISHNAVENI	33	F	70250	-	√	-	-	√	-	-	-
23	Mr.RAJ	16	M	71727	-	√	√	-	-	-	-	-
24	Mr.RAMESH	30	M	1219	√	-	-	-	-	√	-	-
25	Ms.MUTHULAKSHMI	20	F	1826	-	√	√	-	-	-	-	-
26	Mr.SURESH	24	M	12073	-	√	√	-	-	-	-	-
27	Mr.ANTONY MOSES	17	M	16376	√	-	√	-	-	-	-	-
28	Mr.GURUNATHAN	18	M	19455	-	√	√	-	-	-	-	-
29	Mr.ALAGHUDURAI	33	M	21314	-	√	-	-	-	√	-	-

30	Mr.BALASUBRAMANIAN	29	M	22646	√	-	√	-	-	-	-	-
31	Mrs.MALA	23	F	24655	-	√	√	-	-	-	-	-
32	Mr.ARULRAJ	15	M	24657	-	√	-	√	-	-	-	-
33	Mr.AYYAPPAN	20	M	25937	√	-	-	-	√	-	-	-
34	Mr.RAJENDRAN	20	M	27575	√	-	√	-	-	-	-	-
35	Mrs.HEMA MALINI	30	F	29295	-	√	√	-	-	-	-	-
36	Mr.KARUPPUSAMY	27	M	30832	√	-	√	-	-	-	-	-
37	Ms.ESAKKIYAMMAL	21	F	31093	-	√	-	√	-	-	-	-
38	Mrs.JANCY RANI	22	F	35585	-	√	√	-	-	-	-	-
39	Mrs.CHANDRA	52	F	37049	-	√	-	-	-	-	√	-
40	Mr.MAYIL RAVAN	33	M	38358	-	√	√	-	-	-	-	-
41	Mr.ANBHAIAH	19	M	39726	√	-	-	√	-	-	-	-
42	Mr.MANIKANDAN	21	M	39739	√	-	√	-	-	-	-	-
43	Ms.ROSEMARY	19	F	39784	√	-	-	-	√	-	-	-
44	Mr.SUMARAJ	50	M	41293	√	-	-	-	-	-	√	-
45	Mr.SUBRAMANIYAM	20	M	41483	-	√	-	-	√	-	-	-
46	Mr.GURUSAMY	23	M	44198	-	√	√	-	-	-	-	-
47	Mr.VARADHARAJA PERUMAL	27	M	44288	-	√	√	-	-	-	-	-
48	Mr.SOUNDARAJAN	24	M	46828	√	-	√	-	-	-	-	-
49	Mr.PAULDURAI	45	M	46933	-	√	-	-	-	-	√	-
50	Mrs.INDIRA	32	F	47067	-	√	√	-	-	-	-	-
51	Mr.ESWARAN	42	M	47974	√	-	-	-	-	√	-	-
52	Mr.MADHAN	17	M	51039	-	√	√	-	-	-	-	-
53	Mrs.PITCHAIYAMMAL	60	F	52173	√	-	-	-	-	-	√	-
54	Mr.SUBRAMANIYAN	30	M	52203	√	-	-	√	-	-	-	-
55	Mr.SELVAMANI	33	M	53404	√	-	√	-	-	-	-	-
56	Ms.ESAKKIYAMMAL	18	F	53431	√	-	√	-	-	-	-	-
57	Mr.MUTHULINGAM	18	M	56361	-	√	-	√	-	-	-	-
58	Mr.PAULPANDI	25	M	57564	√	-	√	-	-	-	-	-
59	Ms.ESAKKIYAMMAL	18	F	57593	√	-	√	-	-	-	-	-
60	Mr.RAMESH	24	M	57638	-	√	√	-	-	-	-	-
61	Ms.KAVITHA	16	F	60182	√	-	√	-	-	-	-	-

62	Ms.DEVAYANI	16	F	60327	-	√	√	-	-	-	-	-
63	Mr.PRAKASHAPATHY	27	M	65479	√	-	-	√	-	-	-	-
64	Mr.GANESAN	26	M	67298	-	√	√	-	-	-	-	-
65	Ms.GOWRI	19	F	69011	-	√	√	-	-	-	-	-
66	Mrs.CHANDRA	44	F	70271	-	√	-	-	-	√	-	-
67	Mrs.SELVI	45	F	75452	√	-	-	-	-	-	√	-
68	Mr.ESAKKIMUTHU	19	M	1055	√	-	√	-	-	-	-	-
69	Mr.AKASH	18	M	1077	√	-	√	-	-	-	-	-
70	Mrs.NAMBI NATCHIYAR	35	F	1296	-	√	-	√	-	-	-	-
71	Mr.SUDALAI MANI	22	M	3077	√	-	-	√	-	-	-	-
72	Mr.SATHISH KUMAR	26	M	3176	√	-	√	-	-	-	-	-
73	Mr.SEKAR	16	M	3411	√	-	-	-	√	-	-	-
74	Mr.SENDHU RAJA	36	M	4695	√	-	√	-	-	-	-	-
75	Mr.RAVI CHANDRAN	19	M	6255	-	√	√	-	-	-	-	-
76	Mr.BALA MURUGAN	39	M	6303	-	√	-	-	√	-	-	-
77	Ms.KEERTHIGHA VIDHYA	17	F	7457	√	-	-	√	-	-	-	-
78	Mr.KANNAN	20	M	10227	√	-	√	-	-	-	-	-
79	Ms.POOJITHA	16	F	10308	√	-	√	-	-	-	-	-
80	Mr.ARUMUGAM	21	M	11730	-	√	-	√	-	-	-	-
81	Mr.IYYAPPAN	17	M	15644	√	-	√	-	-	-	-	-
82	Mr.KRISHNAN	39	M	15662	√	-	√	-	-	-	-	-
83	Ms.ARUL SELVI	18	F	17003	√	-	√	-	-	-	-	-
84	Mr.KARBAGHA SIVARAMAN	17	M	18773	-	√	-	√	-	-	-	-
85	Mrs.NATCHIYAR	65	F	19506	√	-	-	-	-	√	-	-
86	Mr.AHAMMED KASIM	27	M	20804	√	-	√	-	-	-	-	-
87	Mr.VEMBHURAJ	17	M	21471	-	√	√	-	-	-	-	-
88	Mr.GURUNATHAN	33	M	28812	-	√	-	-	-	√	-	-
89	Ms.PETCHIAMMAL	19	F	31669	-	√	√	-	-	-	-	-
90	Mr.NAVEEN ALEX	18	M	32573	√	-	-	√	-	-	-	-
91	Mr.VENKATA SUBRAMANIYAN	31	M	32622	√	-	-	-	√	-	-	-
92	Mr.PERIYASAMY	17	M	35214	√	-	√	-	-	-	-	-
93	Mrs.DHANAM	40	F	37234	√	-	-	-	-	√	-	-

94	Mr.ALAGHU RAJA	29	M	40129	**√**	-	-	-	-	√	-	-
95	Ms.THANGA KANI	19	F	41969	**-**	√	-	-	√	-	-	-
96	Mr.LAKSHMANAN	15	M	42807	**√**	-	-	√	-	-	-	-
97	Ms.SUMITHRA	15	F	44670	**-**	√	√	-	-	-	-	-
98	Mr.PRADEESH KUMAR	16	M	45969	**-**	√	√	-	-	-	-	-
99	Mr.ASHIK	18	M	48332	**√**	-	-	√	-	-	-	-
100	Mr.MURUGAN	25	M	48354	**√**	-	√	-	-	-	-	-